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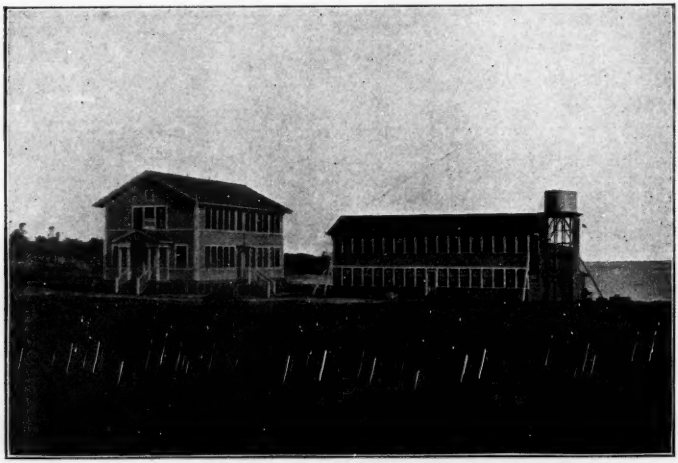
THE HOPKINS SEASIDE LABORATORY.

VERNON L. KELLOGG.

THE Leland Stanford Junior University was formally opened to students Oct. 1, 1891. It is situated on the great Palo Alto estate, whose eight thousand acres carry this unusual college yard from the salt marshes of San Francisco Bay across the intervening valley and over the lesser hills to the foot of the climax of the Santa Cruz Mountains. In the summer recess after the first college year, Stanford had its marine laboratory ready for habitancy. A friend of the university, Mr. Timothy Hopkins, whose practical friendship has been especially enjoyed by the biological departments of the university, provided the money for building and equipping the laboratory, which, in honor of the founder, is officially named "The Hopkins Seaside Laboratory of the Leland Stanford Junior University."

The location chosen for the laboratory by the directors, Professors Jenkins and Gilbert, is the bay side of the promontory, Point Pinos, which is the southern limiting point of the Bay of Monterey. The bay is a great, shallow indentation of the coast line, which offers little protection from the sweep of the open ocean except in its southern part.

Here, on a cliff by the water's edge, are the laboratory buildings. They are two two-story buildings, one sixty feet long by twenty feet wide, the other forty by twenty-six feet. Two large salt-water tanks stand near by. Within, the space is divided into large and small laboratories, rooms for investigators, lecture room, photographic dark room, aquaria, concreted basement rooms, etc. The collecting equipment comprises the necessary dredges and nets, and instruments for sounding and for taking below surface temperatures. The



THE HOPKINS SEASIDE LABORATORY.

laboratory does not own a launch, a sailboat and rowboat having proved, so far, sufficient for the needs of the collectors. The collecting of fishes is chiefly done by Chinese fishermen, of whom a villageful lives but half a mile from the laboratory.

In addition to a fauna more or less peculiar to itself, the Bay of Monterey, being a middle point between the north and south zones of the Pacific coast, finds itself possessed of a number of sub-tropical and sub-boreal types peculiar to the two regions. The Pacific coast of the United States has but few bays; it is a straight coast line bathed by the great swell of the open ocean. In the aggregate the east coast, with its intricate coast line, will present a greater abundance of bay-

shore life, but area for area, the collecting ground about the Hopkins Laboratory is probably unapproached by any spot on the Atlantic coast. A well-known and experienced biologist of the University of Chicago, who spent a summer at the Hopkins Laboratory, has said that Monterey Bay and the Bay of Naples are much alike in the abundance and representation of species. It will be of interest to naturalists to be told in some detail of the actual faunistic conditions of the bay and ocean shore near the Hopkins Laboratory. The laboratory has been long enough established, and the observation and collecting diligently enough prosecuted, to make it possible to undertake this with some confidence. For the statements regarding the invertebrate fauna, I am presenting very largely the observations of Mr. Harold Heath, assistant professor of zoölogy in Stanford University.

The sponges are extremely abundant; in certain localities they encrust the rocks over a large area. There can be no less than thirty species represented. Among the hydroids two or three species also are very numerous, literally covering the rocks at extreme low-tide mark. Sea anemones are plentiful. Certain forms which cover themselves with shells and stones occur between tide marks closely packed together to the number of many thousands. Annelids are numerous, as are certain star worms (Gephyrea), but the vermian class has been as yet little studied. A species of Cirratulus, which lives in the cracks of the rocks, extends its long, thread-like tentacles up through the sand, so that in their abundance and massing they look like tufts of delicate seaweed.

Certain groups of mollusks are unusually well represented. Four or five species of Haliotis are abundant, and are used for food by the Chinese. Many are dried and shipped to China. Limpets are particularly well represented, as also are the nudibranchs, of which thirty or forty species have been noted. About thirty species of Chiton have been found, among them the giant Cryptochiton, six to ten inches long, the only one of the group with a concealed shell. Mytilus forms great beds at low-tide mark, and is used to some extent as food. Among the cephalopods certain species of Loligo are so abun-

dant that the catch of the Chinese fishermen for a single night, when spread out on the ground to dry, will cover five or six acres! The Chinese boats go out by night with nets and pitch-pine torches, which are hung over the boat's side to lure the squid. The squids are dried and shipped to China to be used as food. It is said also that the dried squids are used in China as fertilizer. The duty on fertilizer in China is very low, the duty on salt very high. By mixing a little dried squid with a great deal of salt, and calling it fertilizer, a considerable amount

COAST NEAR THE HOPKINS LABORATORY—VIEW FROM POINT LOBOS.

of salt finds its way into the Celestial Kingdom at a very low duty rate. The giant squid, *Ommatastrephes californica*, and a species of Octopus (punctatus, probably) occur, the latter quite common, and the former not infrequent during the summer, when the rock-cod are young and readily caught.

Crustacea are well represented in certain groups. Amphipods literally swarm everywhere. Isopods, particularly two species of Idothea, are very common. The Brachyura are represented by twenty to twenty-five species, while the Macrura are represented by three or four very numerous hermit crabs and an Alpheus. Copepods are numerous, wonderfully

so in the plankton. They are largely the cause of the phosphorescence of the ocean here. The water sometimes has a light rusty color, which is due to the occasional abundance of Noctiluca.

About sixty kinds of echinoderms have been found. The sea urchins cover the rocks in the strip of land from extreme low tide out for thirty to forty feet, and for distances of miles along the coast. Some of them are of enormous size. *Holothuria californica*, a sea cucumber from ten to twenty inches long, is abundant. A great orange-red Cucumaria, three feet long, is not uncommon. Serpent stars fairly swarm in the sand, together with Synapta. The starfishes are numerous, and there are many large and strikingly colored ones. The Chinese fishermen collect, can, and send to China, to be used as food, large quantities of the reproductive glands of the sea urchins.

Ascidians are as numerous as the sponges, and are found in the same places, encrusting the rocks over about the same areas. The compound forms are especially numerous, but large simple ones suitable for study are not so easily procured.

The fish fauna of the Bay of Monterey and adjacent waters presents numerous special features of interest. Hag-fish and Chimæra are easily collected in large numbers. The rock-cod, a group of peculiar oviparous forms, are abundant in species and individuals. The viviparous surf-fishes, found elsewhere only in Japan, are numerous. The embryos, when they issue from the body of the mother, are surprisingly large in proportion to the size of the adult female. The fish fauna is an unusually large one because of the presence of a number of sub-tropical forms, and many northern forms, in addition to the forms peculiar to the region.

At the extremity of Point Pinos peninsula, and along its rock-bound western or ocean side, there are a number of "bird rocks." These isolated rocks, rising twenty to forty feet above the water, are fairly covered at times with cormorants, pelicans, and gulls. In the breeding season the larger ones are occupied as rookeries by various sea birds. As there are no storms in summer, an excellent opportunity for observing the life of these sea birds is offered, and some extended studies,

especially of the migration of ocean birds, have been made here by Mr. Leverett M. Loomis, of the California Academy of Sciences.

The botanist, too, finds much of unusual interest on this bit of Pacific coast and in the bay and ocean waters of the shore. The Monterey cypress and Monterey pine, two conifers so restricted in their range as almost to warrant the statement that they are to be found naturally only on this little promontory, are the characteristic trees of the region. The cypress is, indeed, found only here, but the pine has a range of a hundred miles, perhaps, along the coast. Point Pinos is, however, the center and the principal point of its occurrence. In the shore waters the botanist is at once impressed with the abundance and enormous size of the brown kelps. *Macrocystis pyrifera* grows to the length of 1000 and 1500 feet; Nereocystis is nearly as large. A number of these brown kelps are monotypic, and are found only on the Californian coast. Among these forms is the interesting sea palm, Postelsia, which grows abundantly on the surf-swept rocks. The red algæ, too, are present in great abundance. In fact Professor D. H. Campbell says that in his acquaintance with the shore waters of America, Europe, Japan, and the West Indies he has found nowhere else so great a number of species, nor so enormous an abundance of individuals, as are displayed in these waters.

The laboratory's regular sessions are held in June and July of each year, but investigators and students working without instruction may continue their work through the summer. Courses in general zoölogy, embryology, and cryptogamic botany are regularly offered, with special courses and lectures depending upon the personnel of the instructing force. The instructors are chiefly members of the biological faculty of Stanford University. Students taking the regular courses are charged a fee of twenty-five dollars; investigators prepared to carry on original work are permitted the use of the laboratory and its equipment free of charge. There are seventeen private rooms for investigators.

The Hopkins Laboratory has a point in common with the Naples Station, which should not go unremarked. The laboratory can be used to advantage at any time in the year. The mid-year holidays always find a group of workers there.

THE NORTH-AMERICAN ARBOREAL SQUIRRELS.

J. A. ALLEN.

No attempt at a critical revision of the American arboreal squirrels has been made since 1878, but during the last two years several noteworthy contributions to this end have appeared, covering practically the Sciuri occurring north of Panama; but those of South America still await revision. The latest and by far the most important of these contributions is Mr. E. W. Nelson's recently published "Revision of the Squirrels of Mexico and Central America,"[1] which marks an epoch in the history of the subject. Mr. Nelson is not only a well-trained naturalist, but has several marked advantages over previous monographers in having at his command not only a far greater amount of material, but material incomparably better in character, and also an intimate acquaintance with the physiographic conditions of the region to which his studies relate, and with the animals themselves in life, gained through eight years' field experience in Mexico and Central America. He has not only thoroughly explored, in company with his assistant, Mr. E. A. Goldman, under the auspices of the United States Biological Survey of the Department of Agriculture, western Guatemala, but has traversed Mexico from sea to sea, and from north to south, on several different lines. Of the 919 specimens on which his monograph is based, more than 600 were collected by himself and assistant. During the preparation of his paper he was "able to examine representatives — and in most cases types or topotypes — of nearly all the known species and subspecies found in Mexico and Central America." The investigation, under such favorable conditions, of the large amount of excellent material at his disposal has led him to recognize 30 species and 13 subspecies as occurring between

[1] *Proc. of the Washington Acad. of Sci.*, vol. i, pp. 15–106, Pls. I and II. Published May 9, 1899.

the southern boundary of the United States and Panama, of which four only extend north of this boundary. In 1877 and 1878 the number recognized, respectively, by Allen and Alston, in their well-known papers on the American Sciuri, was 9 and 7. Not only, however, was the material then available comparatively scanty and poor in quality, but, as Mr. Nelson observes, these authors "were handicapped by the prevailing tendency of the time to lump species."

Under "Notes on Distribution and Variation" Mr. Nelson refers to the definiteness of the ranges of the various species, which is governed by the distribution of the different kinds of forest growth, which in turn is controlled by temperature and moisture.

In his review of the "Subgenera of North-American Species" Mr. Nelson recognizes 10 subgenera, of which four are here first characterized, namely, Baiosciurus, Aræosciurus, Otosciurus, and Hesperosciurus. Three of the 10 subgenera are practically confined to that portion of North America north of Mexico (one entirely so, and two others extending south of the United States only into northern Lower California); two are properly South American, while the remaining five are common to the United States and Mexico. These groups are characterized by differences in size and proportions, together with differences in the shape of the skull and in dentition, and seem to form natural groups, though in general but slightly differentiated. By far the greater part of the tropical forms (10 species and 13 subspecies) belong to the single subgenus Ehinosciurus, which is unrepresented north of Mexico.

According to Mr. Nelson: "Tree squirrels occur in suitable places throughout Mexico and Central America, but the distribution of the various species depends largely upon the character of the forests. Thus *Sciurus negligens* is most abundant in the low dense forests of ebony, less than twenty-five feet high, on the hot coast plains, while its near relative, *S. deppei*, loves the shady depths of the humid tropical forests on the lower mountain slopes where the damp air produces an exuberant tree growth and an abundance of parasitic plants. . . . The larger species exist under even more varied conditions, since they

occur from the hot coast country to the region of oaks and pines close to timber line, but the ranges of different species or subspecies are never coincident and overlap only in a few instances, as in the case of *S. colliæi nuchalis* and *S. poliopus colimensis* on the coast of Colima, and *S. apache* and *S. durangi* in the Sierra Madre.

"Many species change their environment by periodical migrations in search of food, moving from one locality to another with the ripening of fruits or seeds upon which they subsist. This is most marked on high mountains, where a species may have a vertical range of many thousand feet." Mr. Nelson also says: "The effect of climate on the character of the pelage is so marked that it is possible to tell with considerable certainty whether a species belongs to the tropics or to the high mountains. Tropical species have thin pelage, short, thin under fur, and coarse, stiff, or almost bristly, dorsal hairs. . . . These differences are sometimes strikingly shown in subspecies of the same squirrel." Seasonal differences, however, are slight, but individual variation, on the other hand, is often excessive, rendering some species extremely difficult to describe.

"The extraordinary amount of geographical variation in tropical North-American squirrels is due mainly to an unusual plasticity of the organization which allows slight climatic differences to produce visible effects. The most obvious of these influences are differences in temperature and rainfall, with their distribution through the year and consequent effect on vegetation." Thus in the drier interior mountains certain subspecies of a group will be characterized by dull grayish upper parts and white under parts, while other subspecies of the same group inhabiting humid mountains near the coast will have nape and rump patches sharply contrasting with the rest of the dorsal surface and bright ferruginous under parts, increased humidity within the tropics being usually accompanied by increased intensity of coloration.

In this admirable paper Mr. Nelson attempted a most difficult task, which consisted in not only recognizing and defining the various forms of tree squirrels inhabiting tropical North America, but in clearing up the tangle of synonymy involved in the

works of previous authors. As a first step to this result he identified as far as possible the type localities of all the species previously described, and secured from them "topotypes"; and he was further greatly aided by Mr. Oldfield Thomas, of the British Museum, in determining many of Gray's imperfectly described species. While it is too much to expect that Mr. Nelson's revision will be final, especially as regards the Central-American forms, his paper is of the highest importance as a contribution towards reducing to comparative order the chaos that has hitherto prevailed in this difficult field. As a result of his determinations several radical changes of nomenclature have been necessary, including the proper allocation of Erxleben's *Sciurus variegatus*, which has proved so great a source of trouble to previous writers, but which Mr. Nelson has conclusively shown belongs, not to any species of Sciurus, but to a species of Spermophilus! Great credit is due Mr. Nelson for his well-planned and intelligent work in the field, as well as for the careful elaboration of his material and the clear and workmanlike way in which he has presented his results.

In addition to Mr. Nelson's revision of the squirrels of tropical America, two recent contributions have been made to our knowledge of the squirrels of North America north of Mexico.

In December, 1896, Mr. Outram Bangs published "A Review of the Squirrels of Eastern North America,"[1] which included the flying squirrels as well as the ordinary tree squirrels. This paper gave, under the genus Sciurus, four species and six subspecies, three of the latter being described as new, to which Mr. Bangs has since added another subspecies.[2]

The squirrels of western North America have not, as a whole, been recently revised, although much has been incidentally written about them, and several new forms have been described. The chickarees, or red squirrels (subgenus Tamiasciurus), were recently monographed by the present writer.[3] In

[1] *Proc. Biol. Soc. Wash.*, vol. x, pp. 145–167. Published Dec. 28, 1896.

[2] Sciurus (Tamiasciurus) gymnicus, *Proc. N. Engl. Zoöl. Club*, vol. i, p. 28. Published March 31, 1899.

[3] Allen, J. A. Revision of the Chickarees, or North-American Red Squirrels (subgenus Tamiasciurus), *Bull. Am. Mus. Nat. Hist.*, vol. x (1898), pp. 249–298. Published July 22, 1898.

this paper four species and 13 additional subspecies were recognized, four of the latter being described as new.

The last complete revision of the arboreal squirrels of North America north of Mexico was made in 1877,[1] when six species and seven additional subspecies were recognized. Since that date not only has a large number of new forms been added and important changes in nomenclature been made, but the point of view has become radically changed through the accumulation of a vast amount of additional and far better material than was available twenty years ago. In consequence of this it may be a convenience to those interested in our mammals to give in this connection a list of the 10 species and 25 additional subspecies of arboreal squirrels, now recognized by experts as found north of Mexico, with a brief statement of their ranges.

Arboreal Squirrels Found in North America North of Mexico.

SUBGENUS HESPEROSCIURUS NELSON.

1. *Sciurus griseus* Ord. California gray squirrel. Southwestern Washington, western Oregon, and California.

1*a*. *Sciurus griseus nigripes* (Bryant). Coast region of California south of San Francisco.

1*b*. *Sciurus griseus anthonyi* Mearns. Anthony's gray squirrel. Interior of southern and lower California.

SUBGENUS NEOSCIURUS TROUESS.

2. *Sciurus carolinensis* Gmel. Southern gray squirrel. Eastern United States, from southern New York to northern Florida.

2*a*. *Sciurus carolinensis leucotis* (Gapper). Northern gray squirrel. Northern Alleghanies, and northward to New Brunswick and southern Canada.

2*b*. *Sciurus carolinensis hypophæus* Merriam. Merriam's gray squirrel. Minnesota and Wisconsin.

2*c*. *Sciurus carolinensis fuliginosus* (Bachman). Bayou gray squirrel. Coast region of Louisiana.

2*d*. *Sciurus carolinensis extimus* Bangs. Southern half of Florida.

SUBGENUS OTOSCIURUS NELSON.

3. *Sciurus aberti* Woodhouse. Abert's squirrel. Mountains of Colorado, New Mexico, and Arizona.

3*a*. *Sciurus aberti concolor* True. Northeastern Colorado.

[1] Allen, J. A. *Monog. N. Am. Roden.* (1877), pp. 633–778, *passim*.

SUBGENUS PARASCIURUS TROUESS.

4. *Sciurus niger* Linn. Southern fox squirrel. Virginia to southern Florida, east of the Alleghanies, and along the Gulf coast to eastern Louisiana.

5. *Sciurus ludovicianus* Custis. Western fox squirrel. Mississippi Valley, from Louisiana to Michigan, and from the western edge of the Alleghanies to the eastern border of the Plains.

5*a*. *Sciurus ludovicianus vicinus* Bangs. Northern fox squirrel. Mountains of West Virginia northward into western Pennsylvania. Formerly from northern Virginia north to southern New York and southern New England; now extirpated, except at the localities above indicated.

5*b*. *Sciurus ludovicianus limitis* (Baird). Texas fox squirrel. Texas, south into northeastern Mexico.

SUBGENUS ARÆOSCIURUS NELSON.

6. *Sciurus apache* Allen. Apache squirrel. Chiricahua Mountains, Arizona, south into Mexico in the Sierra Madre to Durango.

7. *Sciurus arizonensis* Coues. Arizona squirrel. Mountains of central Arizona.

7*a*. *Sciurus arizonensis huachuca* Allen. Huachuca squirrel. Huachuca Mountains, southern Arizona, south into Sonora.

SUBGENUS TAMIASCIURUS TROUESS.

8. *Sciurus hudsonicus* (Erxl.) Northern chickaree. Canada, north of Ontario and Quebec, east of the Rocky Mountains, and Alaska.

8*a*. *Sciurus hudsonicus gymnicus* Bangs. Northern New England, northern New York, and southern Canada, including New Brunswick, Nova Scotia, Quebec, and Ontario.

8*b*. *Sciurus hudsonicus loquax* Bangs. Southern chickaree. From southern New England, southern New York, and the vicinity of the Great Lakes, south to Virginia, and in the Alleghanies to North Carolina.

8*c*. *Sciurus hudsonicus minnesota*, subsp. nov.[1] Minnesota chickaree.

[1] In my revision of the chickarees (*loc. cit.*) I called special attention to the small size of the chickarees examined from New Hampshire, northern Maine, New Brunswick, and Nova Scotia, and the large size of those from southern Minnesota and Wisconsin, these two phases presenting the extremes in size among the chickarees of eastern North America. They also differ a little in color when series of the two forms are compared, the small Eastern one being somewhat darker than the large Western one. As, however, they grade so insensibly into the Southern (*S. h. loquax*) and Northern (true *S. hudsonicus*) chickarees, respectively, it then seemed to me not worth while to recognize in nomenclature forms so hard to define, either in physical characteristics or geographically. Now that

Minnesota and Wisconsin, and probably Iowa, and eastward to northern Indiana.

8*d*. *Sciurus hudsonicus dakotensis* Allen. Black Hills chickaree. Black Hills, South Dakota, and adjoining portions of Wyoming.

8*e*. *Sciurus hudsonicus baileyi* Allen. Bailey's chickaree. Mountains of central Wyoming and eastern Montana, and northward into Alberta.

8*f*. *Sciurus hudsonicus ventorum* Allen. Wind River Mountains chickaree. Wind River Mountains and northward along the eastern base of the Rocky Mountains in Montana.

8*g*. *Sciurus hudsonicus richardsonii* (Bachman). Richardson's chickaree. Western border of northern Montana, central and northern Idaho, northeastern Washington, and northward into southeastern British Columbia.

8*h*. *Sciurus hudsonicus streatori* Allen. Streator's chickaree. From the central part of northern Washington northward over central British Columbia.

8*i*. *Sciurus hudsonicus vancouverensis* Allen. Vancouver chickaree. Vancouver Island, and northward along the coast to Sitka.

9. *Sciurus douglasii* Bachman. Douglas's chickaree. Coast region of Oregon and Washington.

9*a*. *Sciurus douglasii mollipilosus* (Aud. & Bach). Redwood chickaree. Coast region of northern California (=*Sciurus hudsonicus orarius* Bangs, 1897).

9*b*. *Sciurus douglasii cascadensis* Allen. Cascades chickaree. The Cascades region of Oregon and Washington, north into British Columbia.

Mr. Bangs has given a name to the small Eastern form, and left under *S. h. loquax* the large Minnesota one, it seems admissible, and perhaps advisable, to also name the large Western form.

Mr. Bangs has defined his *S. h. gymnicus* as: "Size smallest; hind foot small; colors all very dark," etc. He gives the size as: "Total length, 300; tail vertebræ, 117; hind foot, 47 mm."

S. h. minnesota may be characterized as size largest of the Eastern chickarees; hind foot large; colors lighter, etc. Total length, 345; tail vertebræ, 143; hind foot, 50 mm. Type, No. 4374, *Am. Mus. Nat. Hist.*, ♀ ad., Fort Snelling, Minn., April 4, 1890. Collected and presented by Dr. Edgar A. Mearns.

Mr. Bangs gives the average measurements of 6 adult topotypes of his *S. h. gymnicus* as: "Total length, 290.2; tail vertebræ, 121.2; hind foot, 44.5 mm. The measurements of 20 topotypes of *S. h. minnesota* measure: Total length, 334; tail vertebræ, 130.2; hind foot, 49.2 mm.

Mr. Bangs also gives the average measurements of 10 adults of *S. h. gymnicus* from Digby, Nova Scotia, presumably from his own collection, which by a singular coincidence agree to a millimeter in all the measurements with a series of the *same number* of specimens, from the *same locality*, given by me in my paper on the chickarees (*loc. cit.*), published nine months earlier.

In comparison with *S. h. loquax* the Minnesota form is as much larger than *S. h. loquax* as *S. h. gymnicus* is smaller, while the color differences are quite as tangible.

9*c*. *Sciurus douglasii albolimbatus* Allen. California chickaree. Sierra Nevada region of California, north into Oregon, east of the Cascades (= *Sciurus hudsonicus californicus* Allen, 1890).

9*d*. *Sciurus douglasii mearnsi* (Townsend). Mearns's chickaree. San Pedro Martir Mountains, Lower California.

10. *Sciurus fremonti* Aud. & Bach. Fremont's chickaree. Mountains of Colorado, north to the southern border of Wyoming, and west to the Uinta Mountains.

10*a*. *Sciurus fremonti neomexicanus* Allen. Taos chickaree. New Mexico.

10*b*. *Sciurus fremonti mogollonensis* (Mearns). Arizona chickaree. Mountains and higher plateaus of central Arizona.

As shown above, the subgenus Hesperosciurus is represented by a single species and an additional subspecies; the subgenus Neosciurus is also represented by a single species with four additional subspecies; the subgenus Otosciurus has a single species and an additional subspecies in the United States, and a second species in Mexico; the subgenus Parasciurus has two species and two additional subspecies; the subgenus Aræosciurus has two species and an additional subspecies in the United States, and three additional species and one subspecies in Mexico; Tamiasciurus has three species and 15 additional subspecies.

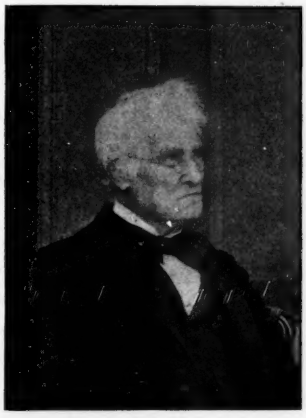
All the *species* of North-American Sciuri are sharply differentiated; the numerous *subspecies* represent for the most part well-marked geographical forms, which characterize more or less natural physiographic areas. In many cases the subspecies, in their extreme phases of development, are strongly differentiated, yet coalesce so completely at intermediate points as to be unsusceptible of sharp definition. They, however, represent stages in the evolution of species, and are facts that may be conveniently made note of by the brief formula of a trinomial name.

ALVIN WENTWORTH CHAPMAN.

WILLIAM TRELEASE.

DR. ALVIN WENTWORTH CHAPMAN, whose *Flora of the Southern United States* has been the only handbook at all useful for a study of the botany of that interesting region for the past thirty years, died at his home in Apalachicola, Florida, on the sixth of April.

No name has been so familiar to the present generation of botanists in the South Atlantic region as that of Dr. Chapman, and yet few botanists now living ever saw him. In the interesting little city at the mouth of the Apalachicola River, where he died, far removed from railroads and the bustle of great manufactures and commerce, he lived a life of seclusion for over half a century; and as he rarely traveled, and the slowness of river and bay transportation make a journey of several days necessary from even the nearer gulf and coast cities before his home is reached, few visitors found their way to him. As a correspondent, even, he was known to relatively few now living. And yet by those who knew him personally, or through his letters, he was beloved to an unusual degree.



ALVIN WENTWORTH CHAPMAN. 1809–1899.

Though a resident of Florida since 1835, Dr. Chapman was originally a New Englander. He was born at Southampton, Mass., Sept. 28, 1809. He graduated at Amherst in 1830, and passed the next few years as a teacher in Georgia and North Carolina. His medical education was completed in Kentucky,

where, at Louisville, in 1835, he took a medical degree. In 1886 the University of North Carolina honored him and itself by conferring on him the degree of Doctor of Laws.

Soon after settling in Florida, Dr. Chapman made the acquaintance of Stephen Croom, at that time an active student of botany, — for whom the genus Croomia was named, — who interested him in the work to which the greater part of his life was to be devoted.

Though he had removed to the South with the intention of making it his home, had married a southern lady, and had resided in the South for a quarter of a century, Dr. Chapman was loyal to the Federal Government when the Civil War came; and though he refused to leave his chosen home, he did not lead a happy life during the continuance of the war. After its conclusion he occupied for a time several municipal and Federal offices in Apalachicola, but the later part of his life was passed in the quiet pursuit of the science to which he was devoted.

In 1860 appeared the first edition of his *Flora of the Southern United States*, concerning which it is said that his friend of many years, Professor Asa Gray, saved the plates from destruction during the troublous times of the war then beginning. A supplement, containing such corrections and additions as had come to his knowledge, was published in 1883. Subsequently (in 1897), as the result of continuous application, a considerably enlarged and entirely revised edition was issued.

Dr. Chapman's original herbarium, which may be considered as the most typical representation of the material on which his *Flora* rested, was many years ago added to the collections at Columbia University. Some years since a second herbarium, which had served as the basis of his revisions, was acquired by the Biltmore establishment, which also purchased the principal part of his library.

On the completion of the revised edition of the *Flora*, and under the burden of more than fourscore years, it might be thought that Dr. Chapman would have abandoned active botanical work. Not so, however. Each season saw him eagerly in the field looking for new facts and gathering new species. Not many years since, to further the work of a much younger man,

he went into the woods, a hundred miles from home, in mid-winter, and made an extensive collection of woody plants in their resting state, finding, as he wrote, no little pleasure in making the acquaintance of many old plant friends in an unwonted guise; and several of the larger herbaria are enriched by the fruits of his work in the field during the last five years of his life. Early in 1898 he went to a favorite collecting ground at Aspalago, just below where the Flint and Chattahoochee rivers join to form the Apalachicola, and had entered upon the preparation of a suite of the beautiful specimens for which he was noted, when an attack of vertigo, the true significance of which he well knew, ended his active labors. "At the age of fourscore years and ten," he wrote, "I have closed the book." And, indeed, from the time of his return from his last collecting trip until death put a final term to the activity of his mind, he was, perforce, content to thumb over and arrange the material in his hands, and to hope that others might make of it that use which was denied him. And yet he did not admit even to himself that he could do no more. The writer had the privilege of a long-promised and long-deferred visit to him shortly before the holidays last winter, and could scarcely prevent him from running out "only about a mile" to point out the habitat of a rare and local shrub. "Come back in the spring," said he, "and I'll try and be well enough to show you some of my collecting grounds, — though," he added, "I'll not take you to my boarding places there, for I don't think you could stand them." And even within a month of his death he walked nearly three miles to secure a desired specimen.

Few men have the natural endowment of so great modesty and disposition to retirement as Dr. Chapman possessed. His herbarium specimens are commonly marked "So. Fl.," to indicate that they were accepted in his *Flora* as properly bearing the names on the labels; but his own name rarely appears on his earlier labels, and is found appended to few published plant names. Running over his last spring's collections with the writer last winter, as one novelty after another was passed in review and its characters indicated, he would say: "But, you know, even if I were not at the end of my work, I should prefer

some one else to name them. I never did care to name species, and so many others do."

At one time in possession of a fairly good fortune, Dr. Chapman was unfortunate in the failure of a bank to which he had intrusted his money, and a sore trial — indeed, the only severe one — of his later years was his inability to foresee where he could get the considerable sum of money needed for the publication of the last edition of his *Flora*. That a friend was found in this time of need, did much to lighten the care of his latest years, in which his wants were of the simplest and most easily gratified, and is not forgotten by those who know the circumstances.

SYNOPSES OF NORTH-AMERICAN INVERTEBRATES.

II. Gordiacea (Hair Worms).

THOMAS H. MONTGOMERY, Jr.

The hair worms have been classed by most writers as allies of the nematodes, based mainly on the similarity in external appearance and in the structure of the body muscular wall. The following comparison of more important structural characters, however, shows that these two groups are only very distantly related, if they are at all genetically connected:

Gordiacea: Body cavity lined by a peritoneum and transversed by dorso-ventral mesenteries; two testes in the male; genital aperture in the female united with the anal aperture (forming a cloaca); the brain has a narrow dorsal and a large ventral commissure, from which passes caudad an unpaired ventral nerve (with a ganglionic thickening at its posterior end), no dorsal median nerve being present.

Nematodes: Body cavity not lined by a peritoneum, and not transversed by mesenteries; one testis in the male; the genital aperture in the female is never united with, but always anterior to, the anal aperture; the brain is a simple ring around the œsophagus, and from it pass caudad a dorsal and a ventral median nerve.

Vejdovský regards the Gordiacea as degenerate annelids, basing his view on the metameric arrangement of the ovaries, the structure of the body cavity, and the presence of the single ventral nerve. But until the embryology of the hair worms is better known, their affinities must remain problematical.

The curious marine worm, Nectonema, whose structure has been described by H. B. Ward (*Bull. Mus. Comp. Zoöl.*, XIII, 3, 1892), has been regarded by this writer as allied to the Gordiacea. But while this affinity seems quite probable, it

cannot be considered proved until the structure of the genital organs of Nectonema is better known, and on this account I do not now include Nectonema among the Gordiacea.

The hair worms are in the adult stage fresh-water forms, very long and slender, with a thick cuticle on the surface of the body, without external segmentation or appendages. They are cylindrical in form, but become flattened after the discharge of the genital products. The head end usually tapers to a point, while the form of the posterior end differs in the two sexes. There are certain genera of nematodes (such as Mermis and Filaria) which bear a close external resemblance to them, but a mature hair worm may be recognized by the following peculiarities: The greater portion of the body is of the same diameter, the posterior end is never sharply pointed, and the surface of the cuticle is marked by elevated areoles or papillæ (the latter often complex in structure), or, by intersecting layers, is divided into rhombs.

The eggs are laid in the water in the form of long strings. From the egg develops a minute larva, characterized by a proboscis armed with hooks, which swims in the water for a short while, then enters into an aquatic insect, usually the larva of a may-fly. The larval stage ends at this point, and the embryonal commences. After a period the still immature and very small worm passes into a new host, most frequently the imago of a coleopterous insect, in the body cavity of which it may complete its development. The mode by which the worm passes into the second host seems to be dependent entirely upon environmental circumstances. In such a case where the first host is the larva of a may-fly, and the second a carnivorous beetle, it has been suggested that in a season of drought, when the pools become dried up, the may-fly is left stranded, and so becomes the easy prey of a beetle, the latter in eating the may-fly larva thus swallowing the young hair worm. But very frequently immature and nearly mature hair worms occur in the body cavity of orthopterous insects, such as grasshoppers and crickets, which are purely herbivorous, and which would probably never consume may-fly larvæ. For these cases two explanations occur to me by which to explain the

transference of the worms into herbivorous insects: (1) The second host, the carnivorous beetle, may die, and at its death the parasitic hair worm pass into a mass of decaying vegetation, and then be inadvertently swallowed by the cricket or grasshopper; or (2) the may-fly larva dies, and the worm after passing out of its body is swallowed by the orthopterous insect. In the first case the herbivorous insect would be the tertiary, in the second the secondary host. Probably at least one change of host always occurs, but there would seem to be no fixed regularity in regard to the sequence of hosts, nor in regard to the species of the host, for it would seem that embryos of the same species of hair worm are able to grow and develop in a variety of hosts. From the body cavity of the final host the worm, now nearly mature, but with its mouth stopped by a cuticular plug so that it can take no further nourishment, escapes in the water again, there to swim about for a time, and there finally to deposit its egg. We have seen that the final host is usually a terrestrial insect; for the worm to reach the water to lay its eggs there, it is necessary that its host, by a rainstorm or flood, become drowned in a body of water.

Probably but a small percentage of the hair worm larvæ ever arrives at the mature condition, since their transmission from host to host, and back to the water again, is so much a matter of environmental chance. There is opportunity for a great deal of study, with promise of interesting results, on the life history of these forms. By a wise provision of nature the genital products ripen prematurely, so that the individuals can reproduce themselves before they themselves are structurally adult.

Hair worms in North America have been found in the nearly mature but still parasitic stage, in Orthoptera (crickets, grasshoppers, Ceutophilus), in beetles (rapacious genera, such as Harpalus), and (rarely) in spiders and Lumbriculus. In other lands they have been found in other groups of insects, in snails, rarely in vertebrates, where their presence is probably purely accidental, as it certainly is in man. In the mature free state they occur in small ditches, small streams, sometimes springs (as *Gordius lineatus*), and large lakes. They appear to be very

irregular and sporadic in occurrence, so that one usually comes upon them accidentally. Occasionally 50 or 100 more individuals are found forming an interlacing ball.

As to the preservative methods, strongly penetrating fluids must be employed, owing to the thick cuticle encircling the body; for good histological fixation it is best to use Flemming's fluid, after cutting the worms into short segments.

The following key is for the species thus far described of the North-American continent, including Mexico; no specimens are yet described from the southeastern United States, nor from north of the United States. We have three well-marked genera: Gordius Linn., Chordodes (Creplin) Möbius, and Paragordius Camer. (Montg.). The females are, as a rule, more difficult to determine than the males, and the females of *Gordius platycephalus* and *G. densareolatus* are often barely distinguishable, while their males may be easily distinguished. This key enables one to readily distinguish the genus and sex, the species of the male individuals, and the females, except those of the genus Gordius, which must be determined by reference to more detailed descriptions. The males of *Chordodes morgani* and *Gordius leidyi*, and the females of *G. longareolatus*, *G. aquaticus difficilis*, and *Chordodes puerilis* are still unknown. *Chordodes puerilis* and *C. morgani* may eventually be found to be the two sexes of the same species.

In the following literature list the papers by Montgomery contain full descriptions of the American species (with figures), as well as references to all previous writings upon them; and the other papers mentioned are the chief systematic monographs on the group:—

1. Camerano: "Monografia dei Gordii." *Accad. Reale delle Sci. di Torino*, 1897.

2. Montgomery: "The Gordiacea of Certain American Collections." *Bull. Mus. Comp. Zoölogy*, Harvard, Vol. XXXII, 1898.

3. Montgomery: *Ibid.*, Pt. II. *Proc. Cal. Acad. Sci.*, 3d Ser., Vol. I, 1898.

4. Römer: "Beitrag zur Systematik der Gordiiden." *Abhandl. Senckenberg. naturforsch. Ges.*, Bd. XXIII.

5. Villot: "Monographie des Dragonneaux (Genre Gordius, Dujardin)." *Arch. Zoöl. gén. et expér.*, Vol. III.

6. Villot: "Révision des Gordius." *Annal. Sci. Nat.* (7) 1.

Key for the Determination of American Gordiacea.[1]

I. Posterior end trilobed, *Paragordius varius* (Leidy), ♀.

II. Posterior end bilobed, spirally enrolled (Paragordius and Gordius), ♂ ♂.

A. A sharp, *V*-shaped ridge behind the cloacal aperture.

a. The cuticle marked with large white spots. *Gordius aquaticus* (Linn.), ♂.

b. The cuticle not marked with white spots.

1. A parabolic line of hairs on the tail lobes. *G. a. difficilis* (Montg.), ♂.

2. No line of hairs on the tale lobes. *G. a. robustus* (Leidy), ♂.

B. No sharp, *V*-shaped cuticular ridge behind the cloacal aperture.

a. A longitudinal line of hairs on each side of the cloacal aperture. *G. lineatus* (Leidy), ♂.

b. No line of hairs on each side of the cloacal aperture.

1. Head end obliquely truncated. *Paragordius varius* (Leidy), ♂.

2. Head end not obliquely truncated.

a. Conical spicules behind the cloacal aperture.

1. Tail lobes short, thick, nearly conical. *Gordius densareolatus* (Montg.), ♂.

2. Tail lobes nearly cylindrical. *G. longareolatus* (Montg.), ♂.

b. No conical spicules behind the cloacal aperture, tail lobes cylindrical. *G. platycephalus* (Montg.), ♂.

III. Posterior end spirally inrolled, but not lobed, narrower than the preceding portion of the body, with a depression or groove on its ventral surface. Chordodes, ♂ ♂.

A. Cuticular areoles longer than high, on and between them small circular pits. *Chordodes occidentalis* (Montg.), ♂.

B. Cuticular areoles higher than long.

a. Spines on the summits of the highest areoles (papillæ). *C. puerilis* (Montg.), ♂.

b. No spines on the summits of the highest papillæ. *C. morgani* (Montg.), ♂.

IV. Posterior end not spirally inrolled, not lobed, not of less diameter than the preceding portion of the body. Chordodes and Gordius, ♀ ♀.

[1] The *American Naturalist* will undertake to determine and return any specimens that cannot be placed in the keys, and solicits correction and criticism for future revision.

A. Posterior end not noticeably enlarged. Gordius, ♀♀.

a. With elevated cuticular areoles on the whole surface of the body.

1. With paired dark stripes in the median lines. *G. leidyi* (Montg.), ♀.

2. No dark stripes in the median lines.

a. Areoles elongated in the long axis of the body, well separated from one another. *G. longareolatus* (Montg.), ♀.

b. Areoles not elongated in the long axis of the body.

1. Areoles closely apposed, tending to produce longitudinal ridges. *G. lineatus* (Leidy), ♀.

2. Areoles more or less confluent, tending to produce transverse rows; head usually cylindrical. *G. densareolatus* (Montg.), ♀.

3. Areoles usually separated, interareolar groups of fine hairs, head usually flattened. *G. platycephalus* (Montg.), ♀.

b. Without elevated cuticular areoles on the whole surface of the body.

1. No cuticular areoles.

a. Cuticle marked with white spots. *G. aquaticus* (Linn.), ♀.

b. Cuticle without white spots. *G. a. robustus* (Leidy), ♀.

2. Cuticular areoles at the ends of the body only. *G. a. difficilis* (Montg.), ♀.

B. Posterior end swollen, somewhat knob-shaped, slightly constricted off. Chordodes, ♀♀.

a. Cuticular areoles longer than high, on and between them small circular pits. *Chordodes occidentalis* (Montg.), ♀.

b. Cuticular areoles higher than long.

1. Spines on the summits of the highest areoles. *C. puerilis* (Montg.), ♀.

2. No spines on the summits of the highest areoles. *C. morgani* (Montg.), ♀.

AN ABNORMAL WAVE IN LAKE ERIE.[1]

HOWARD S. REED.

On July 19, 1895, between 8 and 9 P.M., in the vicinity of Erie, Pa., the waters of Lake Erie suddenly rose in a single wave about six feet high, which advanced upon the shore and after a few moments quietly subsided to their former level. Five miles west of Erie the rise was but three or four feet, and three distinct rises were observed; the first and second rises were about fifteen minutes apart, the second and third about half an hour apart. Fifteen miles east of Erie the rise was about six feet, and but one wave was observed.

The weather on the day referred to was calm and clear where the rise occurred, and had been pleasant on each of the two preceding days, with light variable winds most of the time, and a range of temperature from 80° to 90° *F.*

On the evening of the 19th the sky was cloudy, as if a storm were approaching. All day long the lake had been very calm.

Mr. R. J. Moorehead thus describes the phenomenon, as observed off North East, Pa.:

"Between eight and nine o'clock, while we were sitting near the shore of the lake, the water suddenly rose about six feet, vertically, running back on the beach about sixty feet. But for the sharply shelving beach just at the water's edge, many would undoubtedly have been drowned.

"The day had been calm, no wind, thermometer 91° *F.* in the afternoon.

[1] The writer wishes to acknowledge his obligations for information to Willis L. Moore, Chief of Weather Bureau, U. S. Department of Agriculture; R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Commander E. H. Glenn, Acting Hydrographer, U. S. Navy Department; R. J. Moorehead, North East, Pa.; W. E. Hartt, West Millcreek, Pa.; P. A. Sanborn, North East, Pa. He is also indebted to I. C. Russell, Professor of Geology in the University of Michigan, for friendly suggestions and criticisms.

"When the water subsided, it receded to a distance of fifty-six feet out beyond its normal margin. I paced it during the comparative repose following the recession of the flood, though in a very few minutes it began to assume its normal condition. The flood and outflow did not occupy over a very few minutes, I should say not over five minutes.

"This was followed by calm (no wind during this time) for about ten minutes, when we heard a low ominous roar, gradually increasing in volume, which we knew was the wind coming down the lake; the first visible evidence of it was of wave after wave chasing each other with cumulative force, *directly down the lake*, nearly at right angles with the shore. Every wave was crested, and coming so swiftly (they went like a pack of hounds) that when they struck the rock-bound shore, one hundred yards below us, they took a tangent to the northeast; thus driving their foaming mass out, into, and diagonally across the waves whose course, not having been diverted, was due east, and caused this agitated mass of water to rear and plunge, traveling swiftly like a thing of life, out as far as we could see, as it was now becoming dusk, though still light."

A young man who was bathing in the lake at that point says that the water which came in was very cold and seemed very heavy compared with that which it displaced.

This strange behavior of the lake excited no little comment at the time, and many were the conjectures made to explain the phenomenon. The older people related a similar occurrence which took place some fifty years ago and drowned sheep in lowland pastures.

The 19th of July opened with threatening weather at all stations at the western end of the lake. Between 2.15 and 4 A.M. rain fell at Detroit and at Toledo. At 8 A.M. the observers at Detroit and Erie reported a south wind; the other stations reported a southeast wind. The average velocity of the wind was about seven miles an hour. The barometer was highest at Buffalo, gradually becoming lower toward the western end of the lake. At most of the stations the thermometer was above 90° *F.* at some time during the day, and the muggy atmosphere made the heat the more depressing.

The first indication of any unusual disturbance was at 1.10 P.M., when a small tornado struck the town of St. Clair, Mich. Trees were blown down by the hundreds, and about a dozen houses were seriously damaged. The wind was accompanied by a driving, soaking rain which lasted about thirty minutes. But the tornado was seemingly local in character, as the wind at Marine City, Lenox, and Memphis (near-by towns) was but a zephyr. It is doubtful whether this local stationary storm had any influence directly upon the meteorology of the surrounding country, although it may have started upper air currents, which might have produced results later, especially if it caused high westerly currents.

According to Davis, thunderstorms are often caused in this way, when the higher members of westerly currents overrun the southerly winds for a considerable distance eastward of the line which separates the two winds at the surface of the earth.

At 4.15 P.M., at Detroit, the first thunder of an approaching thunderstorm was heard, and at about 4.30 heavy rain began to fall, ending at 6.40 P.M.

At Toledo the wind had been generally southwest until 4.30 P.M., when a squall suddenly increased it to a gale from the northwest. The flagstaff halyards at the observing station were blown loose and caught around the cups of the anemometer, holding them fast and causing a loss of record until 7.50 P.M. It is estimated that the wind attained a velocity of forty-two miles per hour, with an extreme of sixty, during the first ten minutes of the squall. The barometer fell slowly until 4.20 P.M., then rose suddenly 0.07 inches and remained nearly stationary the rest of the day. The temperature rose rapidly during the day; just before the squall it registered 93°, but fell to 71° *F.* from 4.30 to 5 P.M.

At Point Pelee Island the wind had been blowing from the east and southeast since noon of the 18th. At about 5 P.M. on the 19th a squall increased its velocity from sixteen to twenty-four miles per hour, and changed, oppositely, its direction from east to west, whence it gradually changed to northwest, to northeast, and back to east. Accompanying the squall was the thunderstorm.

Sandusky, Ohio, experienced the gale and rainstorm without thunder. The wind there attained a velocity of fifty miles an hour.

The observer at Cleveland reported brisk variable winds veering from northwest to east, with storm velocities from 6.55 to 7.25 P.M.

The thermometer had risen to 79.2° *F.* at Port Stanley, Ontario. The direction of the wind from 1 A.M. to noon of the 19th had been east and southeast; from noon to midnight the direction was northeast. During the earlier part of the day the velocity of the wind had ranged from ten to seventeen miles per hour, but in the afternoon the velocity gradually diminished, until at 7 P.M. it was but four miles an hour. After the passage of the thunderstorm, which must have occurred here shortly after 7 P.M., the wind velocity suddenly increased to fifteen miles an hour, dropping back, however, to three miles an hour by 9 P.M. and continuing gentle the rest of the night. The thunderstorm reached Port Dover at 7.30 P.M., and there also caused fresh north and west winds.

The meteorological observer at Erie gives the following report for the day: "Very warm and depressing all day, squally at night. A tidal wave six feet high moved from the northwest at 9 P.M. The wind jumped from seven to twenty-four per hour, was severe, but no damage reported."

The observer at Buffalo says: "Generally fair in daytime, with some threatening conditions in morning, and in the evening rain fell shortly after the 8 o'clock observation, continuing showery during the balance of the evening; warm and sultry, with light variable winds. Distant thunder in the southeast."

At Welland, Ontario, the day was partly clear; the highest temperature was 91° *F.* The thunderstorm occurred there at 8 P.M. Niagara experienced much the same kind of weather as Welland, except that the temperature was somewhat lower and the precipitation not nearly so great.

Ordinary lake waves, as is well known, are due to the action of the wind. The friction of the wind on the surface of the water causes undulations in the water which travel in the same direction as the wind. After the wind which caused the waves

has subsided, the gradually diminishing undulations may continue for some time. These undulations are known as the "swell."

From time to time observers near lakes have noticed movements in their waters which could not be classed as ordinary waves. Any such unusual rise of water is popularly termed a "tidal wave," but in reality the tides in lakes are too slight to be detected by any but the most delicate observations. It is much more probable that such disturbances are caused in one of the following ways:

When a heavy wind blows nearly parallel to the length of a rather narrow lake for a day or so, the waters move with it and rise on the shore against which they are driven. In November, 1892, a storm from the west caused the waters of Lake Erie, near Toledo, to fall eight or nine feet below the normal fair-weather level. At the same time unusually high water was experienced at the eastern end of the lake.

Sudden changes in the outlet of a lake may produce changes in the level of its water; as when an outlet is dammed by an ice gorge or by an avalanche.

Earthquakes produce waves in bodies of water, but there are no instances recorded of such waves in lakes.

A *seiche* is a change of level in the waters of a lake, supposed to be due to changes of barometric pressure on different portions of the water surface. There are also certain rhythmical pulsations, producing a difference of level of three or four inches during calms, when no similar variation of atmospheric pressure can be detected.

The seiche has been quite thoroughly studied in the lakes of Switzerland, particularly by Forel, but although similar movements are known to occur in our great lakes, the subject here is one which awaits investigation.

The rise of the waters of Lake Erie, under consideration, was evidently one of these exceptional movements of large water bodies, and by noting the conditions under which it took place we may be able to gain some knowledge as to their causes.

Was it an earthquake wave?

We can be almost certain that it was not; for if any earth-

quake shock had occurred at that hour of the day, it would have been noticed at some point on the shore, or by some vessel on the lake, which was not the case. Furthermore, an earthquake wave of the size noted would not be local, but probably would be noticed at many, if not all, points on the lake shore.

Was it an example of water piled by the wind?

We can be quite sure that this was not the cause, for on the previous evening there was a calm area near the locality where the rise occurred, away from which the wind blew in three or four different directions. And although, after sunrise on the 19th, the wind kept a generally southeast direction, with an average velocity of nine miles an hour, we may be quite sure that so light a wind, blowing upon a large body of water for so short a time, at right angles to its longer axis, could not have been the cause of the phenomenon.

It may be asked if a difference of barometric pressure might not account for the difference of level of the water.

It is very possible that this may be an indirect cause of the rise, but it is not competent in itself to produce such a change in level. By reference to the barometric conditions for the 19th, it will be seen that there was a "high" area near the central portion of the lake at 8 P.M., where the barometer was 0.08 to 0.09 inches higher than at either end of the lake. As a column of mercury thirty inches high corresponds to a column of water thirty-four feet high, the column of water able to be supported by the pressure in the "high" area would only differ about an inch from the column able to be supported by the pressure at either end of the lake. So the water in the central portion of the lake would only need to fluctuate about half an inch in order to establish its equilibrium.

Was the phenomenon a seiche?

Forel gives as causes of seiches: (*a*) rapid local variation of atmospheric pressure; (*b*) relaxation of the wind which has heaped the lake waters up to one side; (*c*) a gust of wind striking the lake obliquely; (*d*) electrical attraction; (*e*) avalanche winds; (*f*) earthquakes; (*g*) storms.

Some of these causes were incontestably present at the time this phenomenon occurred.

We had a heavy gust of wind striking the lake obliquely as a characteristic result of the thunderstorm. All stations at the western end of the lake reported a gale from the northwest as accompanying the thunderstorm.

Another of the causes which was present was a storm. Whether the storm was the principal cause or not, is difficult to say; although, by agitating parts of the lake and causing an unstable equilibrium in the atmosphere, it undoubtedly entered in as a cause.

Theoretically, at least, electrical attraction would have some influence upon the action of the water; but owing to our present incomplete knowledge of the subject we do not know how great the actual effect would be.

In the opinion of the writer the oblique blow given to the water by the northwest wind, and the agitation of water and atmosphere, caused by the storm, were the principal factors causing the result.

This theory seems to be supported by the account of the eyewitness who described the northwest wind following the wave.

There are objections, though, to calling it a seiche. A true seiche is a rhythmic oscillation of the surface of a lake, whereas in this case oscillations seem to have been lacking at some places.

One of the most puzzling circumstances in connection with this phenomenon is the fact that where the wave seems to have struck the shore first, *i.e.*, about five miles west of Erie, where the water is shallow for about four miles out, there were three waves; while fifteen miles east of Erie, where the water is deeper, there was but one wave. In investigating the cause for this change in the make-up of the wave we should encounter much theory and speculation, which would not be entirely reliable unless we knew all the attending conditions. But we can say one thing with some degree of certainty, *viz.*: if the direction of the waves made an angle of less than 45° with the shore line, the first wave striking the shore would be reflected at such an angle that it will meet and combine with the second wave and form a resultant wave farther along the

shore. This wave, in turn, would be reflected from the shore and reënforce the third wave.

The study of seiches in this country is just beginning to receive attention, and there are some questions about them that we will have to leave unanswered until more definite knowledge is obtained concerning them.

After we have pointed out as many causes as we are able we will probably find ourselves repeating the words of G. H. Darwin, when he writes: "Although it is possible to indicate causes competent to produce seiches, we cannot as yet point out the particular cause for any individual seiche. The complication of causes is so great that this degree of uncertainty will probably never be entirely removed."

ANN ARBOR, MICH.

EDITORIAL COMMENT.

Card Catalogue Summaries. — The last twenty-five years have been noteworthy for the active and successful efforts in organizing the ever-increasing literature of the natural sciences, and the publication of magazines devoted exclusively to the listing of new contributions is now a well-established feature of natural-history work. The advantage of interpolation which the card catalogue system has over the book form of publication is gradually being recognized, and we may now be said to be fairly launched in an experiment for the card cataloguing of all zoölogical literature. The immensity of such an undertaking can be appreciated from the rate at which the card catalogue now issued by the Concilium Bibliographicum at Zurich has grown, and by the largeness of even the more moderate of the proposals in the scheme advanced by the Royal Society of London. One of the difficulties which all these projects meet is that of getting at the substance of a paper for the purposes of classification. Although the rhetorical title is largely a thing of the past, the best contrived title is not always sufficient to indicate the full scope of a paper, and recourse must be made, even for simple bibliographical classification, to the body of the work itself. The growing custom of concluding each paper with a brief summary helps much in this respect, but it is inferior, in our opinion, to the plan now being pursued by the editor of the *American Journal of Physiology*. This consists in the issuance with each number of the journal of a sheet of index slips for the contributions published in the given number. Each slip is headed by a full bibliographical reference for the paper which it represents, followed by a very brief abstract (not more than 125 words) of the substance of the paper, and so compactly printed that the whole slip can be pasted, if desired, on a card for catalogue arrangement. This plan possesses the great advantage of having the abstracting done by the author himself, and yet under restrictions as to length from the editor, so that a uniform slip is obtained which is perhaps the most serviceable form in which the paper could be presented for classification. Should all journals which publish original scientific matter adopt this plan, we feel sure that the work of the scientific bibliographer would be immensely aided ; nor are we inclined to believe

that the plan would react in any disadvantageous way on the authors. The preparation of restricted abstracts, such as this plan requires, is at least an exercise in concise composition.

The Introduction of Exotic Animals. — The Yearbook of the U. S. Department of Agriculture for 1898 contains a most important and interesting paper by Mr. T. S. Palmer, entitled "The Danger of Introducing Noxious Animals and Birds." Though Mr. Palmer uses animals and mammals as synonymous terms, his subject would bear more extended treatment. The need of legislation to prevent the importation of species which may become injurious is well and temperately stated; scientific men, however, should unite in preserving the integrity of the natural faunas and floras, and should urge that all laws made to forbid the introduction of exotic species include Mongolian pheasants introduced for sport, and skylarks brought here for the charm of their song.

Colors of Deep-Sea Animals. — In a paper of this title (*Rept. Iowa Acad. Sci., 1898*) Dr. C. C. Nutting explains the occurrence of bright pigments and well-developed eyes in animals from great depths by the existence there of a phosphorescent light emanating from the animals themselves, and in support of his idea advances the fact that cave animals, on the other hand, are colorless and blind. We wish to point out that Dr. Walter Faxon in his report on the Stalk-Eyed Crustacea of the *Albatross* expedition (*Mem. Mus. Comp. Zoöl.*, Vol. XVIII, 1895) devotes a special chapter to the colors of deep-sea Crustacea, and suggests the existence at great depths of a phosphorescent light; and he also emphasizes the opposite conditions existing in cave animals. The prevailing red tints of deep-sea forms are explained by Faxon through simple physiological reactions in the chromatophores owing to the absence of bright light, and in support of his theory cites some of the experiments of Pouchet on shore forms.

REVIEWS OF RECENT LITERATURE.

GENERAL BIOLOGY.

Fertility Inherited. — The sixth of Pearson's famous "Mathematical Contributions to the Theory of Evolution," published in the *Transactions of the Royal Society*, has just appeared. It contains three parts, to which Professor Pearson, Alice Lee, and Leslie Bramley-Moore have contributed. The introductory paragraph reads: "I understand by a *factor of evolution* any source of progressive change in the constants — mean values, variabilities, correlations — which suffice to define an organ or character, or the interrelations of a group of organs or characters, at any stage in any form of life. To demonstrate the existence of such a factor we require to show more than the plausibility of its effectiveness; we need that a numerical measure of the changes in the organic constants shall be obtained from actual statistical data."

As a result of numerical studies on fertility and fecundity[1] in man and the thorough-bred race horse, Pearson concludes: Both fertility and fecundity are inherited, and probably in the manner prescribed by Galton's Law of Ancestral Heredity.

Among the other valuable results are methods of finding the coefficient of correlation between brethren and between uncles and nephews, calculating from the means of the "relatives" or "arrays."

The importance of the demonstration of the inheritance of fertility lies in the fact that the most fertile class tends to form a larger and larger percentage of the whole population. Now fertility is correlated with various physical qualities; consequently, these physical qualities are bound to become predominant, if there is no interfering factor at work.

Energy of Living Protoplasm.[2] — In this thoughtful work the famous pupil of Nägeli has carried the science of the chemistry of

[1] *Fertility* is defined as the total number of actual offspring, while *fecundity* is the ratio of this last number to the maximum possible number under the circumstances.

[2] Loew, O. *Die chemische Energie der lebenden Zellen.* München, E. Wolff, 175 pp.

growth and life, of which his master was one of the founders, to a wonderful degree of advancement. The work is a summary of the ideas with which the readers of Loew's numerous papers and his books, entitled *Ein natürliches System der Giftwirkungen* and *The Energy of Living Protoplasm*, have already become familiar.

The theory of Loew starts with the principle that there is a profound difference between living and dead protoplasm. This difference shows itself in the different reactions of living and dead protoplasm; for certain relatively inert substances are fatal poisons, whereas they have no effect on dead protoplasm. The essential living substance must consequently be chemically an extremely unstable, labile substance. This lability depends upon the presence of both aldehyde and amido-groups. Such an extremely labile aldehyde as the theory calls for has been demonstrated to occur in protoplasm. Life depends upon the activities of this labile protoplasm.

The work contains also a theory of albumen formation which has simplicity and completeness in its favor, even though every step has not been experimentally proved. Another valuable chapter is that giving a theory of respiration. Thus, throughout the book the results of biochemistry are used for the interpretation of biological phenomena. It follows that it is a book with which every biologist should make himself acquainted.

C. B. D.

Green Amœbæ. — Dr. A. Gruber, of Freiburg i. Br., has maintained for seven years a small aquarium originally stocked by a bit of dried Sphagnum from the Connecticut valley in Massachusetts. He reports[1] that the fauna, which at first consisted of Rhizopoda, Paramœcium, and Rotifera, is now reduced to a single species of green Amœba and *Paramœcium bursaria*. Both of these forms are found in considerable numbers, being most numerous during the warmer part of the year. Repeated examinations have never as yet detected conjugation stages, nor has any indication of division been observed, though the latter must take place. Both species are abundantly supplied with Zoöchlorellæ, and neither has been observed in recent years to partake of food. Indeed, all food organisms have died off in the aquarium. The Amœba still, after the manner of its forbears, engulfs the shells of Euglypha and Centropyxis, but these are dead and empty. The author infers that by virtue of the commensal Zoöchlorellæ these surviving organisms are living a vegetative life,

[1] Gruber, A. Ueber grüne Amöben, *Ber. Naturf. Ges. zu Freiburg*, Bd. xi (1899), pp. 59–61.

independent of the customary food of the species. When placed in the dark, the green organisms disappear and the death of the Amœba by hunger ensues. Colonies thrive in minute drops of water which would quickly foul were not the Zoöchlorellæ present to renew the supply of oxygen.

C. A. K.

ZOÖLOGY.

The Fossil Bisons of North America. — Mr. Frederic A. Lucas, Curator of the Division of Comparative Anatomy in the U. S. National Museum, has published a most valuable contribution to our knowledge of the Fossil Bisons of North America. His paper,[1] consisting of less than twenty pages of text, is illustrated by twenty half-tone plates, mostly of skulls and horn cores, reproduced from photographs, and representing nearly all of the authentic material of this character relating to the subject. Mr. Lucas has evidently given much time and great care to the preparation of this excellent paper, and has placed the subject, so far as is possible from the scanty material at present extant, on a sound basis. That such a review was much needed is evident, in view of his conclusions.

Seven species are recognized, the distinctive characters of which are based mainly on their horn cores, which he has found afford very good specific characters. The skulls, where available, are found to substantiate the differences shown by the horn cores. The teeth of the various species so closely resemble those of the existing Bison that no attempt has been made to name or identify individual teeth.

The localities from which Bison remains have been reported indicate that the group formerly occurred from Alaska southward to California, Arizona, and Florida; other localities are Idaho, Nebraska, Kansas, Texas, South Carolina, and Kentucky. They range in time from the Pleistocene to the present, and in all probability several of the species were contemporaneous. The seven species recognized by Mr. Lucas, with the localities at which their remains have been found, are as follows:

(1) *Bison bison* (Linn.). Subfossil and recent. Remains in a semi-fossil condition have been found at Big Bone Lick, Kentucky; Millwood, Kansas; loess of the Missouri in the Winnebago Reservation.

[1] The Fossil Bisons of North America, *Proc. U. S. National Museum*, vol. xxi, pp. 755–771, Pls. LXV–LXXXIV, with several text-figures.

(2) *Bison occidenialis* Lucas. Fort Yukon, Alaska, and Gove County, Kansas, in the Quaternary, the Kansas specimen being "a practically complete skeleton." This is a larger species than *B. bison*, with well-marked cranial differences.

(3) *Bison antiquus* Leidy. Big Bone Lick, Kentucky; Alameda County (post-Pliocene gravel) and Pilarcitos Valley, California (blue clay, twenty-one feet below the surface). *Bison californicus* Rhoads (*Proc. Acad. Nat. Sci.*, Phila., 1897, p. 501) was based on California specimens.

(4) *Bison crassicornis* Richardson. Eschscholtz Bay, Alaska. (*B. alaskensis* Rhoads, *loc. cit.*, p. 490).

(5) *Bison alleni* Marsh. Pleistocene, Blue River, near Manhattan, Kansas (type locality), and Snake River, near American Falls, Idaho. *Bison crampianus* Cope, 1894, from southern Kansas, is considered to be the same.

(6) *Bison ferox* Marsh. Pleistocene (?) of Nebraska.

(7) *Bison latifrons* (Harlan). Big Bone Lick, Kentucky (type locality), and Ohio, Texas, Mississippi, South Carolina, Georgia, and Florida. *Bos arizonica* Blake, from Arizona, is referred to this species.

In addition to the above, the following, described as species of Bison, have proved not to belong to this genus, namely, *Bos scaphoceras* Cope, from northern Nicaragua, which proves to be referable to the genus Ovis; and *Bison alticornis* Marsh, based on the horn cores of a Dinosaur (Triceratops), as determined later by Marsh himself.

J. A. A.

"Wild Animals I Have Known."[1] — This book is unique in conception and illustration, and the publishers have given it a daintiness of form quite in keeping with the delicacy of touch that marks its literary and artistic execution. The book is not only as pleasing to the eye as it is out of the ordinary in style of make-up, but is one of the most valuable contributions to animal psychology and biography that has yet appeared. Mr. Thompson is not only a naturalist and an animal artist of very high attainments, but is master of a literary style that is at once graphic and fascinating, though doubtless much of the charm of the book is due to his sympatnetic love of the wild

[1] Thompson, Ernest Seton. *Wild Animals I Have Known*, and 200 drawings. Being the Personal Histories of Lobo, Silverspot, Raggylug, Bingo, the Springfield Fox, the Pacing Mustang, Wully, and Redruff. New York, Charles Scribner's Sons, 1898. 8vo, 358 pp., 30 pls.

animals he has come to know so intimately, and whose traits he is thus able to depict so successfully with both pen and brush. To him "animals are creatures with wants and feelings differing in degree only from our own"; this being the case, "they surely have their rights." "Man has nothing that the animals have not at least a vestige of; the animals have nothing that man does not in some degree share." These sentiments are the keynote of the book. His animals are treated as individual personalities, and through this individuality of treatment we get a deeper insight into the life history of the species than if, in the place of "Lobo, the King of Currumpaw," he had given us a long dissertation on the natural history of the wolf, or, in place of "Raggylug, the Story of a Cottontail," he had treated of the life history of cottontails in general.

The eight "stories" in this book treat of: (1) "Lobo, the King of Currumpaw," a famous wolf of the Currumpaw region of northern New Mexico, which for years, as leader of a pack of outlaws, evaded capture, meantime making heavy inroads upon the young calves, colts, and sheep of the ranchmen. His cunning, his heroism, and his pathetic ending are most effectively recounted. (2) "Silverspot, the Story of a Crow," purports to be the individual history of a crow that had his home in the neighborhood of Toronto, and which was distinguishable from other crows by an albinistic spot of white on the side of his head in front of the eye. (3) "Raggylug, the Story of a Cottontail Rabbit." "Raggylug" was distinguishable from his fellows by a slit in one ear. (4) "Bingo, the Story of My Dog," relates to a Collie dog, remarkable for his intelligence, strength, courage, and faithfulness to his master. (5) "The Springfield Fox" is a tale of the intelligence and cunning of a pair of foxes, and of the pathetic love of the mother fox for her unfortunate offspring. (6) "The Pacing Mustang" gives the life of a wild black stallion of the Currumpaw region, renowned for his sagacity and endurance, which ends, like the other stories, in tragedy. "The fact that these stories are true is the reason why all are tragic. The life of a wild animal *always has a tragic end*," says our author, for which statement there is a large amount of evidence. (7) "Wully, the Story of a Yaller Dog," is composite, relating to two mongrels raised as sheepdogs, which were faithful and efficient protectors of their flocks by day, and bloodthirsty, treacherous monsters at night, killing for mere pleasure not only sheep but other dogs, they leading double lives, like many a human monster. (8) "Redruff, the Story of a Don Valley Partridge," is a real character, and his somewhat

idealized career vividly epitomizes the experiences and traits of his tribe. Indeed, the author admits that in some of these stories the characters are pieced together of fragments relating to several individuals, yet no violence is rendered to the general truthfulness of the narration in giving to the incidents the unity of a single individuality.

It is evident that the author of *Wild Animals I Have Known* is a keen woodsman, as well as an accomplished artist and writer, and has given us a book that opens a new field to our vision — a book equally well adapted to young and old, and one which cannot fail to inspire interest in and kindness of feeling toward the beasts that are our kin.

J. A. A.

Ichthyologia Ohiensis.[1] — Dr. Call should have the thanks of American ichthyologists for his transcript of this valuable and very rare work by one of the pioneers of American faunistics. Only eight copies of the original text are known to be in existence. The transcript is from the original articles which appeared in the *Western Review and Miscellaneous Magazine* during the years 1819–21, and afterwards reprinted from the same type in one volume. A biographical sketch of seven and an essay of eleven pages on the ichthyologic work of Rafinesque precede the text of the *Ichthyologia*, which is followed by a bibliography of thirty-three titles and an appendix containing the transcript of an autograph letter with the facsimile of a drawing by Rafinesque of *Pomolobus chrysochloris*. The book is handsomely printed on heavy paper and is limited to 250 numbered copies.

Recent Contributions of Dr. Boulenger to Ichthyology. — Dr. G. A. Boulenger, of the British Museum, has published a third fascicle of materials for the fauna of the Congo, containing descriptions and plates of many new species, chiefly Siluroids. This series is printed at Brussels under the auspices of the Congo Free State, and reflects great credit on the public spirit of that late comer into the assembly of nations. Dr. Boulenger gives in the *Bulletin of the University of Turin* a report on the fishes collected by Dr. Enrico Festa about Panama. The new species are the following: *Piabucina festæ* from

[1] Rafinesque, C. *Ichthyologia Ohiensis;* or, Natural History of the Fishes Inhabiting the River Ohio and its Tributary Streams. A Verbatim et Literatim Reprint of the Original, with a Sketch of the Life, the Ichthyologic Work, and the Ichthyological Bibliography of Rafinesque, by Richard Ellsworth Call, Cleveland. The Burrows Bros. Co., 1899. 175 pp., 8vo, portrait.

Laguna della Pita. *Hippoglossina sabanensis* from Rio Sabana. In this paper Dr. Boulenger seems to have abandoned his respect for the law of priority in nomenclature, to which he has usually shown a proper regard. There is no obvious reason for reverting to Mesoprion, when Lutjanus has priority and the sanction of large current usage. Nor is there any justification for using Pristifoma for Pomadasis. Naturalists must either use the oldest unoccupied generic name, or else abandon all rule and each one do as he pleases. The result of this line of action is the present confusion, from which the rigid application of the law of priority offers the only means of escape.

In the same *Bulletin* Dr. Boulenger continues the discussion of the fishes of Ecuador collected by Dr. Enrico Festa. The species for the most part are identical with those found at Panama. The following new species are described: *Pristifoma labraciforme* from the Bay of Ste. Hélène, Santa Elena, a species close to Poey's *Pomadasis ramosus*, *Hæmulon helenæ* from the Bay of Santa Elena, *Corvina miacanthus* from Guayaquil. This species belongs to the modern genus Bairdiella, *Heros festæ*, from Rio Guayas, Guayaquil.

In the *Annals and Magazine of Natural History* Dr. Boulenger notes the occurrence of *Lepidopus* (or *Benthodesmus*) *atlanticus* at Madeira. The same species has been also recorded from Portugal under the name of *Lepidopus argenteus*. He also discusses the species of the genus Callanthias and describes a new Anabas from the Congo.

Under the auspices of the Department of Agriculture of the Cape of Good Hope, Dr. Boulenger describes two new gobies from the Cape, *Gobius gilchristi* and *Callionymus costatus*.

In the *Proceedings of the Zoölogical Society of London* Dr. Boulenger has a valuable review of the genera and species of Mormyridæ. In this paper stress is laid on the numbers of vertebræ, and these have been counted by means of the Röntgen rays, an interesting application of a discovery in physics to systematic zoölogy. D. S. J.

Teeth of Lizards and Snakes. — The structure and development of the teeth in lizards and snakes have been studied by Dr. H. Levy.[1] The outer enamel layer and the inner dentine layer are clearly distinguishable, and there is no transition in these two layers, as has been claimed for the lower vertebrates. In the development of the

[1] Levy, H. Beiträge zur Kenntnis des Baues und der Entwickelung der Zähne bei den Reptilien, *Jenaische Zeitschrift für Naturwissenschaft*, Bd. xxxii, pp 313–346, Taf. xi.

teeth no superficial germs such as Röse has described in the crocodile were met with, but all germs were, as in the higher vertebrates, deep-seated. In lizards, as in mammals, a dental ridge is formed; this gives rise to a double row of germs, from which the zigzag row of teeth in the adult are produced. The palatine teeth, occasionally found in the lizard, are probably formed from detached germs of this ridge. In snakes the roof of the mouth has on each side two parallel rows of teeth. The origin of these two rows was studied to ascertain whether they came from the same or separate dental ridges. At an early stage the snake possesses a single dental ridge corresponding to the outer row of teeth. Somewhat later two ridges are present, one for the inner and the other for the outer row. From lack of material the author was unable to determine whether both ridges came from the single original one or were formed independently. The dental ridges eventually break up and form small "epithelium nests," from which the germs of the later successional teeth develop. G. H. P.

The Digestive Tract of the Cat. — The morphology of the digestive tract of the cat has been carefully investigated by Dr. Franklin Dexter.[1] Most of the work was done by the dissection of properly hardened embryos, a method much more expeditious and certain than that of reconstruction from sections, but applicable, of course, only to the larger specimens. Dr. Dexter, however, is to be congratulated for having succeeded in dissecting embryos which in the hands of many would have been consigned to the microtome.

At early stages much of the large and small intestine of the cat is contained, not in the body cavity proper, but in the extension of this space into the umbilical cord. This condition has already been observed by Mall in the human subject and in the pig, and has also been identified by Dr. Dexter in the dog and the rabbit. It may be generally characteristic of mammalian embryos. In the cat, part of the liver even may be lodged for a short time in the cord, and the excessive growth of the liver is supposed to be the occasion of this extra-embryonic migration of the intestine. The return of the intestine to the body cavity is accomplished in an orderly sequence: first, a simultaneous entrance of the two extremities of the intestine; secondly, an entrance of the jejunum; and, thirdly, of the remaining portion of the ileum.

[1] Dexter, Franklin. On the Morphology of the Digestive Tract of the Cat. Reprinted from the *Archiv für Anatomie und Physiologie, Anat. Abt.* Boston, 1899.

The differentiation of the colon is also described. After the return of the intestine from its extra-embryonic position, the cæcum, which marks the cephalic end of the colon, lies in the median plane. The cæcum then shifts to the left, and the part of the tube extending from it to the rectum stretches over the course of the descending colon. The growth of the tube in length now carries the cæcum transversely across the body cavity, thus laying out the course of the transverse colon. The tube at last extends caudally on the right side, bringing the cæcum to its adult position and establishing the ascending colon.

The coils of the small intestine were also carefully studied, but no common type of arrangement could be discovered even in embryos of the same litter and of the same size. As the small intestine, hardened in place in five adult cats, showed no common features so far as positions of coils were concerned, it may be assumed that there is no regularity in this respect in the cat.

The paper is concluded with an account of the changes in bulk and form shown by the liver and the probable influences which these have on the disposal of the viscera.

G. H. P.

Regeneration of Arthropod Appendages.[1] — Readers of Bateson's "Materials for the Study of Variation" will recall the experiments made by him and Mr. Brindley on the peculiarities of the regenerated legs of the Blattidæ. Brindley has continued this work and gone over the literature of regeneration in arthropods, and concludes that the regenerated appendage follows one or the other of two types:

(1) In all respects, such as the number of joints and their relative dimensions, the reproduced appendage is the counterpart of the normal congenital appendage.

(2) The reproduced appendage differs from the normal appendage in certain respects which are constant, and in cases where maturity of the animal is attained through a series of ecdyses the special features of the reproduced appendage are perpetuated, so that, strictly speaking, the animal does not reproduce the normal appendage. The chief distinguishing feature of this kind of reproduction is that the number of joints present is *less* than in the normal appendage.

Morphology of the Protobranchia. — An interesting account of the habits, structure, and development of *Yoldia limatula*, *Nucula*

[1] Brindley, H. H. On Certain Characters of Reproduced Appendages in Arthropoda, Particularly in the Blattidæ, *Proc. Zoöl. Soc.*, London, for the year 1898.

delphinodonta, and *N. proxima*, from the coast of Maine, is given by Dr. G. A. Drew.[1] The mantle of Yoldia is supplied with two pairs of sense organs and a fringe of marginal tentacles. There is also an unpaired extensible siphonal tentacle which is protruded upon the surface of the mud in which the animal is buried. Development shows that this is homologous with the marginal tentacles. The foot of all the forms studied serves as a burrowing organ, not as a structure for creeping, as has often been supposed. The palps are active collectors of food, and the gills in Yoldia are very efficient pumping organs. The otocysts are provided with degenerating canals which lead toward the surface, and the genital ducts join the outer, not the inner, ends of the excretory organs. The eggs of *N. delphinodonta* are carried in cases of mucus-like material, while those of the other two species are cast free in the water. The embryos of the first-named species have no locomotor bands, and a feeble apical cluster of cilia, and their development is less rapid. The species of Nucula agree with Yoldia, which has been most fully studied,[2] in the formation of an ectodermal "test" which is afterwards cast off. From this primitive covering the definitive ectoderm, the nervous system, and the stomodæum are formed. The openings of the proctodæum and stomodæum are close together in the region of the primitive blastopore. At the time of metamorphosis the stomodæum, from its primitive opening to the position of the adult mouth, is cast off, together with a part of the apical plate. The test of these protobranchs is held to be the homologue of the velum of the molluscan larva, which has developed from ancestors resembling the embryos of Yoldia and Nucula in form and structure. Chiton, Teredo, Cardium, and Polydordius are known to cast away the velum of the larval stage. The test of the protobranchs is strikingly similar to that found by Pruvot on the embryo of Dondersia one of the primitive group of Solenogastres.

C. A. K.

Innervation of the Pharynx. — The innervation of the laryngeal muscles is an important point in settling their homologies with the muscles of the branchiate vertebrates. The usual statement is that the recurrens nerve supplies all the muscles except the *M. cricothy-*

[1] Drew, G. A. Some Observations on the Habits, Anatomy, and Embryology of Members of the Protobranchia, *Anat. Anz.*, Bd. xv, Nr. 24 (1899), pp. 493–519. With 21 figures.

[2] Drew, G. A. Yoldia limatula, *Mem. Biol. Lab. J. H. Univ.*, vol. iv, No. 3 (1899), 37 pp., 5 pls.

reoideus. Neumayer has recently published the results of his studies.[1] He finds that (1) the recurrens supplies the muscles cricoarytenoideus posticus and lateralis and the thyreoarytenoideus; (2) the recurrens, together with the laryngeus superior, innervate the interarytenoideus transversus and obliquus, the aryepiglotticus and the muscles of the false vocal cord; (3) the cricothyreoideus is supplied by the laryngeus superior.

Holland's Butterfly Book[2] is what its title claims, "a popular guide to a knowledge of the butterflies of North America," and compares very favorably with the numerous books upon butterflies published in England and on the continent. The forty-eight plates are, as a whole, excellent, and will enable an amateur to identify a very large proportion of the butterflies he may collect. The scientific value of the illustrations would have been enhanced if the species figured from the original types had been indicated. The text cannot be regarded as a contribution to science, and the essentially popular character of the work in no way justifies the flippant and egotistical style employed. With "the entire literature relating to the subject" at command, strictly scientific data, such as the distribution of the species, should have been stated more accurately and in greater detail.

The book is sold at a very reasonable price, and it is hoped that its sale will enable Dr. Holland to carry out his intention and issue a similar volume upon the moths of North America. This is even more needed than *The Butterfly Book.*

Embryos of Bdellostoma. — Franz Doflein describes[3] several embryonic stages of Bdellostoma which he obtained at Pacific Grove, California. Before oviposition the eggs lie in a fold of the mesovarium which increases in size and becomes richly vascular and forms a complicated follicle apparatus. The characteristic hooks do not appear until the eggs have reached their full size. They are then formed in pockets of the follicular apparatus, the rest of which forms the horny shell. Only a small per cent of the eggs taken are fertilized, and apparently fertilization takes place outside the mother. The embryo appears on the flat side of the egg, the head being towards the opercular pole. Doflein describes, and his figures show

[1] *Sitzungsber. Gesell. Morph. und Physiol.*, vol. xiv, p. 142, München, 1899.

[2] Holland, W. J. *The Butterfly Book.* A popular guide to a knowledge of the butterflies of North America. New York, Doubleday & McClure Co., 1898. xx + 382 pp., 8vo, 48 colored plates and text-figures.

[3] *Sitzungsber. Gesell. Morph. und Physiol.*, vol. xiv, p. 105, München, 1899.

clearly that the embryo is formed by concrescence. At first the embryo increases in length largely by the formation of new somites, but after about one hundred myotomes appear, growth seems to be more in the increase in size of the somites. Especially noticeable are the large blood sinuses which develop around the embryo. No sections are described in the paper.

The Primitive Pulmonate Kidney. — Meisenheimer points out (*Zeits. wiss. Zool.*, Vol. LXV, 1899) that the apparently distinct types of primitive kidney found in Stylommatophora and Basommatophora can be reduced to a simple tube, closed at its inner end by a differentiated ciliated cell. In the process of differentiation the tube of the Basommatophora retains constantly four cells, while in the Stylommatophora the number is greatly increased. In the Basommatophora one cell becomes greatly enlarged, and in this the process of excretion is concentrated, while no such giant cell is developed in the other group, but excretion is performed by many cells. It is difficult to homologize this system with that found in other molluscs. Meisenheimer points out the similarities of this system to the conditions occurring in the Plathelmenthes, and cites this as an additional proof of the origin of the molluscs from the flat worms.

Life History of the Dicyemids. — As a result of studies of Californian dicyemids, Wheeler concludes (*Zool. Anz.*, Bd. XXII, p. 169, 1899) that the same Dicyema is first nematogen and later rhombogen, and that the so-called infusoriform embryo is, as van Beneden suggested, the male dicyemid. From the relations of the infusorigens and the life history of the animals Wheeler concludes that the male dicyemids arise from fertilized eggs, while the females are produced parthenogenetically. Wheeler points out that this interpretation throws little light upon the systematic position of these forms, since their reproduction is very different from the flat worms. He thinks, therefore, that they should not be an Anhang to the Plathelminthes, while he also thinks they are not worthy of being erected into a subkingdom Mesozoa.

Origin of the Cartilages of the Head. — Lundborg has studied embryos of trout, frog, siredon, and acanthias, and comes to the conclusion (*Morph. Jahrbuch*, Bd. XXVII, p. 242, 1899) that the chondrocranium is of ectodermal origin. He calls attention to the fact that all of the cartilages of the head arise upon the ventral

surface and only later extend to the dorsal side, and would explain this condition by the fact that all of the dorsal ectoderm has been utilized in the formation of nervous tissue. In the same journal (pp. 208 ff.) Dr. H. K. Corning comes to directly the opposite conclusions. His observations were made upon the embryos of the frog, and he bases his opinions upon the negative appearances of the forms studied, and also upon a critical analysis of Miss Platt's papers.

Zoölogical Notes. — In the journal of the Queckett Microscopical Club Mr. D. J. Scourfield has described the winter egg of *Leydigia acanthocercoides*. The proto-ephippium of this rare lynceid is the most highly organized of any yet found in the group and approaches that of the Daphnidæ. The author is engaged upon a study of the epipphia of the Cladocera and desires material for investigation.

The Copepoda of Lincoln, Neb., have been enumerated by Mr. A. D. Brewer in the last number of the journal of the Cincinnati Society of Natural History.

Regeneration in Crustacea has been studied comparatively in many groups by Przibram (*Arb. Zool. Inst.*, Wien, Bd. XI). The author calls attention to the extraordinary resemblance of the regeneration phenomena in organisms to the regeneration of crystals.

Miss Rathbun (*N. A. Fauna*, No. 14) enumerates four species of decapod crustacea from Tres Marias Islands, off the west coast of Mexico.

Miss Harriet Richardson has just published a key to the isopod crustacea of the Pacific coast of the United States (*Proc. U. S. Nat. Mus.*, Vol. XXI, pp. 815–869, 1899). Ninety-seven species are enumerated, including the terrestrial forms.

North-American entomology has had no keener observer or more careful and conscientious recorder than the late Henry G. Hubbard. Since his death Mr. E. A. Schwarz has printed two series of Mr. Hubbard's most interesting letters; one, in *Entomological News* for April, describes the home of *Dinapate wrightii;* and a second, in *Psyche* for May, gives an account of the insect fauna of the giant cactus of Arizona.

No. 4 of Vol. XXV of the *Transactions of the American Entomological Society* concludes with Fox's study of the North-American Mutillidæ. The high character maintained by this society in all of its publications is well illustrated in this most admirable paper.

It so rarely happens that a second edition of a systematic paper on insects is called for, that it may be well to note the issuance, as a special bulletin of the Hatch experiment station of the Massachusetts Agricultural College, of a revised edition of Professor Fernald's Pterophoridæ of North America (cf. *Amer. Nat.*, August, 1898, Vol. XXXII, pp. 596, 597). Five new species are characterized, but the date of publication, July 30, 1898, unfortunately precludes the consideration of the suggestions and corrections made by Lord Walsingham in the *Entomologist's Monthly Magazine* for August and September, 1898.

The position of Yoldia and Nucula as among the most primitive lamellibranchs lends especial interest to Dr. Gilman Drew's recent summary of the known features of the anatomy and embryology of American representatives of these genera (*Anat. Anzeiger*, Bd. XIV, p. 493, 1899).

The ampullæ of Lorenzini in the selachians are described by Forsell (*Zeit. wiss. Zool.*, Bd. LXV, 1899), who, however, does not add much to our knowledge of the function of these problematical organs.

The periods of sexual maturity of the animals of the Gulf of Napies are enumerated by Dr. Salvatore Lo Bianco in the last Heft of Bd. XIII of the Naples *Mittheilungen*. The list occupies about 125 pages. We have already called attention to similar work carried on by Professor Bumpus at Woods Holl.

The urogenital organs of the turtles are described from the anatomical standpoint by Möller (*Zeit. wiss. Zool.*, Bd. LXV, 1899).

Ravn points out (*Anat. Anz.*, Bd. XV, p. 528, 1899) that the septum transversum of the vertebrates is developed by the union of the mesocardia lateralia, which meet in the middle line. Those interested in this subject and the closely allied one of the origin of the diaphragm of the mammals must consult the recent article by Hochstetter upon the formation of partitions in the body cavity of the saurians (*Morph. Jahrbuch*, Bd. XXVII, p. 263, 1899).

A new edition of van Gehuchten's admirable text-book, *Le système nerveux de l'homme*, is announced for the end of the current year.

The Australian Bower-Birds, their nests, eggs, and playgrounds, are described and illustrated by photographic reproductions in the *Proceedings of the Edinburgh Royal Physical Society* for 1897–98.

BOTANY.

The New York Botanical Garden. — The recently issued fourth *Bulletin of the New York Botanical Garden*[1] carries the first volume of that publication to page 294 and Plate VIII. In addition to administrative reports for the year 1898, the present number contains the following botanical contributions: Britton, "Description of a New Stonecrop [*Sedum Mexicanum*] from Mexico"; Rydberg, "The Cespitose Willows of Arctic America and the Rocky Mountains"; Small, "Undescribed Plants of the Southern United States"; and Nash, "New Grasses from the Southern United States."

The Chelsea Botanical Garden. — According to *Natural Science* for May this garden, which was founded about 1673 by the Apothecaries' Company, and has of late proved a greater burden to the society than they wished to carry, has been turned over to the trustees of the London Parochial Charities, who undertake to provide £800 annually for its maintenance. It is a matter for congratulation that this historic establishment has thus been saved.

Corn Plants. — In an attractively gotten up little volume[2] Mr. Sargent presents for young people some of the important facts concerning the cereals used for breadstuffs.

Botanical Notes. — Dr. Boerlage has begun the publication of a quarto catalogue of the phanerogams (with the exception of herbs) cultivated in the great garden at Buitenzorg, Java. The first fascicle, of 59 pages, contains the orders from Ranunculaceæ to Polygalaceæ, inclusive.

A revision of the genus Listera is published by Karl M. Wiegand in the *Bulletin of the Torrey Botanical Club* for April.

Nos. 4 and 5 of the current volume of the *Memoirs of the Boston Society of Natural History* are partly botanical and consist, respectively, of papers on "Localized Stages in Development in Plants and Animals," by R. T. Jackson, and "The Development, Structure, and Affinities of the Genus Equisetum," by E. C. Jeffrey.

[1] *Bulletin of the New York Botanical Garden*, vol. i, No. 4. Issued April 13, 1899. 8vo.

[2] Sargent, F. L. *Corn Plants, their Uses and Ways of Life.* Boston and New York, Houghton, Mifflin & Co. 32 f., ix + 106 pp.

With Lieferung No. 184–5, Parts II–V of *Engler und Prantl's Natürlichen Pflanzenfamilien* are brought to an end, so that the treatment of the phanerogams is now finished, with a complete index to popular names, etc., and to the Latin names of genera and species mentioned.

The New England Botanical Club announces in *Rhodora* for May its intention to publish a check list of New England plants, indicating the presence or absence of each admitted species or variety for each of the six New England States.

Quercus ellipsoidalis is the name applied by E. J. Hill in the *Botanical Gazette* for March to a black oak found in the vicinity of Chicago, which possesses a blending of the characters of *Q. coccinea, velutina,* and *palustris.*

The dissemination of Arceuthobium, or, as it is now sometimes called, Razoumofskya, is the subject of an interesting paper by MacDougal, in a recent number of *Minnesota Botanical Studies.*

The Columbine Association has secured an admirable presentation of the claims of the beautiful flower whose name it bears to recognition as our national flower in an address on "The National Flower Movement," by the president of the association, Mr. F. L. Sargent, delivered before the Massachusetts Horticultural Society in February, 1898, and printed in the recently issued first part of the *Transactions* of the society for 1898.

The phylogeny of Ulmaceæ is discussed by Houlbert in an illustrated article published in No. 123 of the *Revue Générale de Botanique.* A comparative study of the arrangement of the wood elements during the maturation of the trunk (which does not reach its characteristic development until about the tenth year) shows that the structure passes successively through stages comparable with those characteristic of the Boehmerias, Planera, Sponia, and Morus.

A new limnoplankton form, reported by Zacharias (*Biol. Centralb.*, Vol. XIX, No. 9, p. 285) as common in the smaller lakes of Holstein, has recently been identified by the fungologist Ludwig as a modified form of the musk fungus, *Cucurbitaria aquæductum,* which is common in water pipes and on water wheels.

GEOLOGY.

The Physiography and Geology of the Nicaragua Canal Route were studied by Dr. C. Willard Hayes, of the United States Geological Survey, during ten months' field work in 1898, in connection with the surveys made by the Nicaragua Canal Commission, of which Admiral J. B. Walker is president. The more general results of these studies have recently been published in a concise form and should be of interest to naturalists as well as to geographers and geologists.[1] The summary of the conclusions reached, as published by Dr. Hayes at the close of his admirable paper, is as follows:

"The region discussed embraces the belt of country extending from the Caribbean Sea to the Pacific in northern Costa Rica and southern Nicaragua, adjacent to the route of the proposed Nicaragua canal.

"Its most important physiographic feature is the broad depression which extends diagonally across the isthmus, between the recent volcanic ranges on the southwest and the Chontales hills on the northeast. The topography of this depression is chiefly that of an old land, generally reduced to the condition of a peneplain by streams flowing in opposite directions from a former divide near the axis of the isthmus.

"The rainfall on the Caribbean side of the isthmus is very abundant and distributed uniformly throughout the year. On the Pacific side it is less abundant and confined to half the year. This climatic difference produces striking differences in vegetation, rock decay, rate of erosion, and resulting topographic forms.

"The rocks of the region are largely volcanic products, with two sedimentary formations of Tertiary (Oligocene) age, and no rocks occur which are certainly older than the Tertiary. The igneous rocks are in part contemporaneous with the Tertiary sedimentary formations and in part recent.

"On the east side high temperature with abundant moisture and consequent rank and rapidly decaying vegetation afford exceptionally favorable conditions for rock decay, which has extended to great depths and yields red clay as the final product. On the west side alternate wet and dry seasons afford less favorable conditions for rock decay, and the final product is blue clay.

[1] Hayes, C. Willard. Physiography and Geology of Region Adjacent to the Nicaragua Canal Route, *Bull. Geol. Soc. Amer.*, vol. x (1899), pp. 285–348, Pls. XXX–XXXII.

"In early Tertiary (Oligocene) time there was probably free communication across this portion of the isthmus between the Atlantic and the Pacific. A great mass of sediments was deposited in a shallow sea, and many volcanoes were in active eruption.

"In middle Tertiary time the region was elevated and subjected to long-continued subaërial degradation, and the narrower portion of the isthmus was reduced to a peneplain, with monadnocks at the divide near the axis. There is no evidence that open communication has existed between the two oceans across this portion of the isthmus since the middle Tertiary uplift.

"In post-Tertiary time the region was again elevated, and the previously developed peneplain deeply trenched.

"A recent slight subsidence has drowned the lower courses of the river valleys, and the estuaries thus formed have subsequently been filled with alluvial deposits.

"Recent volcanic eruptions have formed a barrier across the outlet of a bay which formerly indented the Pacific coast. The waters rose behind this barrier until they reached the level of a low gap in the continental divide, when they discharged to the eastward and the divide was shifted to the newly formed land near the Pacific coast. Lakes Managua and Nicaragua thus occupy the bed of the former bay and the basins of rivers which were tributary to it."

Accompanying the paper is a map of the region adjacent to the canal route, showing the positions of active and extinct volcanoes, present and former continental divide, former Pacific coast line, proposed canal route, etc.; and a sheet of geological sections.

ISRAEL C. RUSSELL.

NEWS.

PROFESSOR C. J. HERRICK, of Denison University, has been awarded the Cartwright prize of $500, by Columbia University, for his work upon the brain of fishes.

One feature of the work of the veterinary congress, held in Baden August 9–14, is an attempt to provide a uniform anatomical nomenclature.

For the present, at least, the collections of the Museum of Practical Geology, in Jermyn Street, London, will not be merged with those of the Natural History Department of the British Museum.

Some of the botanists propose to make one day of the meeting of the American Association for the Advancement of Science at Columbus a memorial day in honor of Sullivant and Lesquereux, who lived for many years in that city.

Dr. D. G. Brinton has presented his valuable library, relating to American linguistics, to the University of Pennsylvania.

Columbia University has recently received the conchological collections of the late Henry D. Van Nostrand.

Professor L. V. Pirsson, of Yale University, succeeds the late Professor Marsh as an editor of the *American Journal of Science and Arts.*

It now seems probable that $20,000 will be raised for Mr. J. E. S. Moore's expedition to investigate Lake Tanganyika.

The legislature of Arkansas has made provision for the publication of the remaining reports of Dr. J. C. Branner, for several years state geologist. These reports are largely economic in character and deal with the coal, clays, bauxite, kaolin, zinc, and lead deposits. Some of the earlier reports are out of print, and these will be reprinted.

The state of Wisconsin has appropriated $10,000 for two years for a geological and natural history survey of the state. Professor E. A. Birge, of the state university, is the director of the survey.

The corner stone of a museum of oceanography, founded by the Prince of Monaco, was laid on April 26. Representatives of the

French and German governments were present. The museum is intended to contain the collections of the yacht *Princess Alice*, which for several years has been engaged in the study of the fauna of the deep seas.

Columbia University has recently received $10,000, to be known as the Dyckman Fund, the interest of which will be used in the encouragement of biological research on the part of graduate students.

Mr. J. Dörfler, Barichgasse 36, Wien, III, Austria, is preparing a new edition of his directory of botanists, which will be issued about the first of next year.

A school of geography is about to be established in the University of Oxford through the coöperation of the university and the Royal Geographical Society, each institution to bear half of the expense. It will be under the direction of Mr. H. J. Mackinder, who has held the position of reader in geography for the past twelve years.

Mr. F. V. Bennett has resigned from the Geological Survey of the United Kingdom after a service of over thirty years.

Dr. Adolf Fich, professor of physiology in the University of Würzburg, has resigned on account of age.

The *Naturalists' Directory* will be reëdited for 1899 by S. E. Cassino.

Appointments: Dr. A. P. Anderson, assistant professor of botany in the University of Minnesota. — Dr. Wilhelm Benecke, of Strassburg, docent for botany in the University of Kiel. — Dr. Alfred Bergeat, of Munich, professor of mineralogy and geology in the mining academy at Clausthal. — Dr. Franz Boas, professor of anthropology in Columbia University. —Professor Alessandro Coggi, of Perugia, professor of zoölogy and comparative anatomy in the University of Sienna. — Dr. Nikolaus Karl Czermak, professor of anatomy, histology, and embryology in the University of Dorpat. — Dr. von Elterlein, docent for mineralogy and geology in the University of Erlangen. — Dr. Enrico Festa, assistant in the zoölogical museum of the University of Turin. — Dr. Alberto Fucini, docent for paleontology and geology in the University of Pisa. — Dr. Ercole Giacomini, of Sienna, associate-professor of zoölogy and comparative anatomy in the University of Perugia. — Dr. Hugo Glück, docent for botany in the University of Heidelberg. — Dr. J. M. Janse, director of the botanical gardens at Leiden. — Dr. Max Koch, of Berlin, titular professor of geology. — Dr. A. C. Lane, state geologist of Michigan. — Dr. G. Lindau, custos of the Royal Botanical Museum in Berlin. — Albert

Lindström, prosector in the Karolinian Institute in Stockholm, honorary professor. — Dr. Günther Beck von Mannagetta, of Vienna, professor of systematic botany in the German University of Prag. — A. J. Pieters, first assistant in botany in the Department of Agriculture at Washington. — Dr. Antonio Porta, assistant in the zoölogical museum of the University of Parma. — Dr. Otto Stapf, chief assistant in the Kew herbarium. — Dr. Weinschenck, docent for mineralogy and geology in the Munich Technical School. — Dr. Karl Wenle, of Berlin, directorial assistant in the Ethnological Museum in Leipzig.

Deaths: Otto Böckeler, botanist, at Vavel, Oldenburg, March 5, aged 96. — Charles Brogniart, assistant in entomology in the Paris Museum of Natural History, aged 40. — Thomas A. Bruhin, botanist, in Basel. — Abbe Francisco Castracane, student of diatoms at Rome, aged 82. — Dr. A. W. Chapman, well known for his former studies of the flora of the southern states, at Apalachicola, Fla., April 6, in his ninetieth year. — Johann Dorfinger, student of lepidoptera in Vienna, March 19, aged 86. — Joseph J. Dowling, ornithologist, at Dublin, February 2. — Otto Gelert, botanist, at Copenhagen, March 20. — Dr. Gremley, a botanist, at Egelshofen. — Sylvanus Hanley, conchologist. — Franz Ritter von Hauer, a well-known geologist and former director of the Austrian geological survey in Vienna, March 20, aged 77. — Dr. Theodor von Hessling, formerly professor of anatomy in the University of Munich, aged 83. — Dr. H. B. Herretson, an English oculist and ornithologist, aged 49. — James Hogg, well known to the older generation of microscopists, in London, April 23, aged 82. — John Lee, an English botanist, January 20, aged 49. — Sir Frederick McCoy, professor of natural science in the University of Melbourne, well known for his geological investigations, aged 76. He was a native of Dublin, but had lived in Australia since 1854. — Dr. F. Minà Palumbo, a Sicilian zoölogist, March 12, aged 85. — Dr. Rijke, professor of natural history at Leiden, aged 85. — Edward W. Roper, conchologist, in San Diego, Cal., December 31, aged 40. — Rev. Alfred Charles Smith, ornithologist, in Devizes, England, December 7. — Joseph Stevens, of Reading, England, archæologist and geologist, April 7, aged 81. — G. C. Swallow, for several years state geologist of Missouri, April 20, aged 82. — Dr. C. C. Wallich, of the British Army, aged 83. — J. H. Wifbe, of Schenectady, N. Y., botanist, aged 60. — Franz Woenig, botanist, at Leipzig. — Mr. Joseph Wolf, the artist whose illustrations of zoölogical works are familiar to all.

CORRESPONDENCE.

THE NEEDS OF AMERICAN ANTHROPOLOGISTS.

THERE are a few things which American anthropologists are much in need of. Anthropology is making steady progress in this country, as can be seen in the increase of workers in the science; in the amount and quality of their publications; in the number of universities and colleges, which include some part of the science in their curricula; and, finally, in the growing public interest in anthropology. Among the most recent important advantages to the science may be mentioned the establishment of a larger efficient journal, the *American Anthropologist.* At about the same time the *American Naturalist* decided to devote regularly to anthropology a part equal to that given to any of the older sciences. Section H of the American Association for the Advancement of Science has held, since 1897, two meetings a year, and both the meetings of last year met with large success. The Washington Anthropological Society has been recently strengthened by joining an allied body; while in New York there have been held the last season, under the auspices of the Academy of Sciences, successful monthly anthropological meetings. Regular courses or lectures in anthropology are given in the Columbia, Harvard, and other universities. The University of Iowa has recently organized a comprehensive anthropologic course; and there are many lectures on ethnology or archæology delivered more or less irregularly in New York, Washington, Brooklyn, Chicago, Boston, and, I believe, in San Francisco. Besides all this, much work is being actually done in the field. I need mention only the Jessup expeditions under Dr. Boas to the northwestern coast and into Asia, by the American Museum of Natural History; the expeditions southwest into the Pueblo region, by Messrs. Fewkes and Pepper; the expeditions into Mexico, by Messrs. Saville, Lumholz, Starr, and Holmes; the work which is being done in Ohio, by Mr. Moorehead and others; and the tireless efforts in the Trenton gravels and elsewhere, under the direction of Professor Fred. W. Putman. In fact, this list would have to be much prolonged in order to do justice to all the men who are or have been recently active in important field work.

All this shows beyond a doubt that the American anthropologists are active and progressing. When any science in a given country arrives at such a stage of activity as here outlined, there arise certain wants which, if attended to, make further progress more definite, systematic, and easier. Under such circumstances it is fortunate if there are established in other countries well-tried precedents which fulfill similar wants of the same science. We have such precedents in anthropology. We find them particularly in France, but also in England, Germany, and Italy. There are many good examples to follow in supplying our needs, and there are also some occurrences which ought to serve as a warning.

The one need of American anthropologists which I consider important above everything else is the establishment of an *Anthropological Institute.* There is needed a common independent center, such as the French anthropologists have in their Institute of Broca, the English in the Institute of Great Britain and Ireland. The French example is much the better, the English center being a little more than a clubhouse. Broca's Institute is a great depository of anthropologic material, which otherwise would be scattered or lost; it is a laboratory in the full sense of the word; it is a great school for students in anthropology, who come there from all countries; its lectures are free to the public; it possesses a large and very valuable anthropologic library, and almost a complete collection of anthropologic instruments, and both the books and instruments stand there for ready reference or use; finally, the Institute is the center of French anthropologists, to which are presented their best efforts, in which are held their sessions, and in which originate the most powerful impulses for further work.

The moral and practical influence of such an establishment on the science for which it stands cannot be measured. Can any one estimate how much good such an Institute could be to the American anthropologists of to-day and of the future? The American anthropologist has a great deal of difficult work before him. He is confronted with problems which are not equaled in number or importance by those of any other country. The problems do not concern the United States alone, but the whole extent of both Americas, and they are so complicated, large, and numerous, that they will require the best scientific talent and attention for generations to come. Nothing could more facilitate the solution of these problems than a first-class anthropological Institute.

As immigration progresses and various countries on this continent,

and especially in South America, become peopled, anthropology will be taken up in different places beyond the United States. By that time the United States ought to be to America in anthropology what France has been and still is to Europe. But this it cannot be without one or rather a number of first-class Institutes, which would offer everything to the foreign student which he will not be able to find at home.

It is very plain why the United States, more than any other country on this continent, should become the leader in anthropology. No other American country possesses such resources and, perhaps it might be added with justice, none such an abundance of apt and, particularly, energetic workers.

How would the establishment of an anthropological Institute be practicable? Paris gave as a place for the Broca's Institute a part of one of its public buildings, and the French government supports the establishment. Similar things might be done here, were a few influential citizens and officers of some large scientific center, or of some state, interested in the proposition. Possibly the government of the United States itself would support the project. The aid of the government would of all be the most desirable, and with it the execution of the project the most feasible. The government supports the American Bureau of Ethnology, besides other allied institutions. Perhaps the scope of the Bureau of Ethnology, which is doing excellent anthropological work, could be enlarged, until the bureau would comprise all classes of anthropological work and at the same time develop into a center of instruction in the science. In such a case there ought to be at least two branch Institutes, one in New York and one in Chicago. In case of the failure of government or state or city support, there still exists the possibility of securing the interest of one or more wealthy private persons. But all these are mere theories, and it is not my object to advocate any of them specifically. My sole aim is to arouse interest among American anthropologists in this proposition, and if I succeed in this, the practical way of effecting the project will surely be found later.

There are other things which American anthropologists, particularly those who occupy themselves more with somatological investigation, need besides an Institute, and the most important of these are a *uniform, definite nomenclature* and a *uniform system of measurements*. There are practically two systems of anthropological nomenclature, as well as of measurements, in existence; namely, the French and the German. The result of this is much confusion. It is difficult

to see why the clear, concise system of measuring, and the terms which were used by the French and English anthropologists, were modified by the Germans. The change resulted in great loss of work, especially on the German side; but this is no occasion for any critical dissertation on this subject. The fact is that there are two different systems of nomenclature and measurements, and that the American anthropologists must choose *one* of these systems in order to avoid much confusion and loss of work on their side. Furthermore, there are terms used somewhat vaguely by both the European schools and a few new terms, the meaning of all of which should soon be made as definite as possible. It might be well not to do anything in nomenclature unless it is in accord with at least the majority of European anthropologists. Section H of the American Anthropological Association of Science is the best body in which steps leading to a standard American anthropological nomenclature and measurements should be taken. Something to this effect has already been done in the section. But this society should not act, except in concord with the English and French anthropological branches of the Associations for the Advancement of Science and with the Berlin anthropologische Gesellschaft.

A few words about new terms. The coining of many new terms in anthropology is decidedly injurious and meets with much antipathy, unless the new terms were really needed and designate really new things or conceptions.

In addition to the above I should like to call the attention of the American anthropologists to a few things which would prove of advantage.

In the first place, the American student of anthropology would be exceedingly grateful to his masters, would they present him with a concise but complete history of the science in this country. It is only recently that the American Medico-Psychological Association appointed a committee for the purpose of collecting materials for and writing the history of Psychiatry in this country. Perhaps we could follow their most commendable example and do as much in our section in the American Association for the Advancement of Science.

Besides lacking the history of the science, the student of anthropology in this country is much in need of reliable translations and cheap editions of American anthropological classics. There are many very valuable works of this sort in Spanish and other foreign languages, and even in English, that are accessible to but very few. We need something like the medical publications of the Sydenham Society.

So far as practical anthropological work is concerned, it is very advisable that early efforts should be extended to obtain permission for free exploration in Mexico and other American republics. There are great gaps in our knowledge and collections of these regions, and efforts to fill these meet with more and more difficulty, especially in Mexico, on account of the restrictions imposed upon explorations. These restrictions would be excusable if they would lead to the securing of the very valuable archæological and ethnological material found in the countries where these rules have been made, but such is far from being the case. The countries which are richest in various remains do very little to preserve these remains. In the mean time valuable things are being constantly destroyed by ignorant people. The anthropologists of the United States should not allow these matters to go on, but make a determined effort to have the restrictions to explorations recalled. At this very moment one of the Mexican custom houses holds a valuable and largely unique, though fortunately not large, American collection. The collection consists of petroglyphs which were obtained at great pains from the deep Sierras, where they were going to a speedy ruin. They are held on the supposition that they are parts of "some Aztec temple."

In the last place, it seems to me to be to our best interest to prevent as far as possible the exportation of other than duplicate specimens of American aboriginal art into Europe. Many collections that go to Europe, particularly to Germany and France, could be bought here. This would save the American student the necessity of consulting, in his investigations concerning his own or near countries, European publications and museums.

A. HRDLICKA.

NEW YORK.

PUBLICATIONS RECEIVED.

(The regular Exchanges of the *American Naturalist* are not included.)

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